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THE CONDOR

VOLUME 56

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FOOD HABITS OF NESTING GOLDEN EAGLES IN THE COAST RANGES OF CALIFORNIA

By S. KENT CARNIE

The present paper summarizes observations on the hunting methods and the prey of 17 pairs of Golden Eagles (*Aquila chrysaetos*) studied on their nesting grounds in central California in the period from 1947 to 1952. Field work was conducted in that portion of the inner coastal ranges extending from Mt. Diablo in Contra Costa County south to the Pinnacles National Monument in San Benito County. In this region the Golden Eagle, for a raptorial species, is still a common resident. In one instance the nests of four pairs of eagles formed a trapezoid the largest side of which was not over two miles in length. Returns from seven of 33 young eagles banded in their nests indicate no extensive movement of the population. All recoveries were from the coast ranges in central California.

From 1947 to 1950 observations were made in conjunction with other work, resulting at best in only a few visits per nest per season. During 1951 and 1952, however, considerable field time was devoted to studying the food and feeding habits of this species in an attempt to follow systematically as many nests as possible through the entire nesting season.

Nests of 17 pairs of eagles were examined. Food items were recorded by the writer on 68 visits. In addition, data from nine visits made previously to some of the same nests by Dr. Harold M. Hill and Albert J. Wool are included in the present paper.

ACKNOWLEDGEMENTS

The writer particularly wishes to acknowledge the generous assistance and cooperation of Dr. A. Starker Leopold of the Museum of Vertebrate Zoology, who made this study possible. Stuart O. Landry of the same institution was helpful in the identification of skeletal remains. Albert J. Wool and Dr. Harold M. Hill aided both in the field and by generously allowing the writer to draw upon their field notes. William B. Kurtz and John D. McCarty helped in the field, while E. Philip Pister prepared much bibliographical material. George W. Pracy kindly permitted entry into otherwise closed areas in which much of the study was carried out.

TECHNIQUES

The principal method of study was to record periodically the food items found in and about the nests. During visits in the nesting seasons of 1947 to 1950 inclusive, no attempt was made to remove prey items to prevent recount at a later date. However, since visits were of such a sporadic nature during this period, the possible error appears negligible. During the final two seasons of the study (1951 and 1952), visits to closer nests were spaced from five to seven days apart, and to more distant nests from 12 to 14 days apart. To prevent later recount, all prey items were removed after being recorded with the usual exception of one fresh item which was left as food for the young. The item left behind was noted and marked distinctively by removing claws to insure later recognition.

Frequently prey items were only identifiable by legs or feet, especially in the case of jackrabbits and fawns. In such cases, the number of individuals listed as present was determined by the largest number of any one part.

On the initial visit to each nest an attempt was made to collect all weathered remains of prey from previous seasons to prevent possible error in later visits. Such prey was identified and has been entered in table 1 under a separate heading.

NESTING

The majority of the eagles studied (14 pairs) constructed their nests in tall trees (fig. 1). The remaining three pairs nested on cliffs ranging from 40 to 300 feet in height



Fig. 1. The writer at a nest in northern Santa Clara County, California, May 8, 1951. Terrain visible in background is typical of that utilized by eagles in northern portion of study area. Photograph by A. Starker Leopold.

(fig. 2). Both tree and cliff nesting pairs often used alternate nests during different nesting seasons. Eggs, commonly two, were laid in late February or early March, hatching after an incubation period of 33 to 35 days. The young remained in the nest 65 to 70 days. It was during this period, in which the young were being fed in the nest by the adults, that the majority of the food habits information presented here was gathered.

HUNTING METHODS

During the normal course of field work, adult eagles frequently were seen hunting in the vicinity of the nests. During the latter phase of the study, six days were spent specifically observing the hunting methods of several pairs of eagles. Although some variation occurred, the hunting techniques utilized by all these birds were essentially the same. The basic hunting pattern consisted of soaring flight 100 to 300 feet above the ground, along the tops or upper faces of large open ridges in the vicinity of the nest, interspersed with low flights (± 25 ft.) coursing back and forth over patches of poison oak, small brushy draws, or rocky outcroppings. Eagles were observed making kills from both high soaring flights and low coursing flights.

The birds spent much time perching and preening on prominent rocky outcroppings or on bare trees affording good observation of the area about the nest. Perching did not appear to be a major means of watching for prey, as in some raptorial species. In one case, however, an adult female was observed to leave her perch on a rocky point two minutes after having settled there and fly across a wide canyon in a straight, unwavering flight to the top of the opposite ridge over a mile away where she killed and ate a striped skunk. It is my impression that the skunk was seen by the eagle before it left the perch, since the flight was directly to the prey.



Fig. 2. View from a cliff nest in northern San Benito County, California, May 30, 1952. Terrain is typical of that utilized by eagles in southern portion of study area.

As the nesting season progressed and the young required less parental care, there was an increased tendency for the adults to hunt together. Singly or together, however, the hunting pattern remained essentially the same except that when together one bird frequently would maintain the soaring flight while the other descended and coursed over localized areas.

It appears that hunting in pairs is a fairly common occurrence in the Golden Eagle, even to the point of combined efforts in making a kill. Albert J. Wool, a keen field observer who has lived in the study area for many years, describes the following specific instances. On the 31st of October, 1950, a pair of eagles was observed pursuing a Great Blue Heron down the bottom of a narrow canyon in northern Santa Clara County. The heron descended to the ground at the base of a thick clump of alders along the edge of the stream. One of the eagles moved downstream, circling over a clearing among the alders while the second gained several hundred feet in altitude and then dove toward the top of the tree beneath which the heron stood. The heron flew from the base of the alders and as it entered the clearing downstream the eagle circling there descended and grasped it, both birds falling into the shallow stream where they were joined by the

second eagle. With much struggling the eagles finally dragged the heron from the water. Apparently startled by Mr. Wool, both eagles left the heron and flew downstream. The heron was found to be stunned and bleeding but it was not dead. Two hours later, returning to the spot where he had left the heron, Mr. Wool heard a commotion about 100 yards up the steep, overgrown hillside and upon investigation both eagles were flushed and the partially eaten remains of the heron were found.

On June 6, 1937, a pair of eagles was observed killing a fawn on the slope of a steep ridge in northern Santa Clara County. The eagles were seen flying and calling over a patch of brush. As a doe and fawn left the patch the eagles swooped at the fawn, one hitting it and knocking it down the hillside; but it recovered and ran into a brushy draw. While one eagle alternately circled overhead and perched in a sycamore tree, the other alighted on the hillside and walked into the brush patch, following a cow trail. Locating the fawn, the eagle moved to its side and struck at it repeatedly with one wing, but made no attempt to use its beak or talons. The fawn screamed but did not leave the protection of the brush. Movement by Mr. Wool flushed both the fawn and the eagles. When the fawn had bounded some 50 yards down the hill both eagles swooped at it, the first knocking it off its feet and down the hillside and the second grasping it. As Mr. Wool approached, the eagle left the hillside carrying the fawn. The bird was 15 feet off the ground when it finally dropped the fawn and flew off. The fawn died a few minutes later. There were talon wounds behind the shoulders and in the abdomen.

In none of the observed kills were the adults ever seen to fly directly with the prey from the point of the kill to the nest, a circuitous route being used each time. Observations were not extensive enough to determine whether the same route was used each trip to bring prey to the nest.

Even among nesting pairs hunting close by one another under apparently identical conditions, differences existed in types and species of prey items brought to the nests. There appeared to be a degree of preference or specialization on the part of certain adults in obtaining particular types of prey. This was especially noticeable in the case of the four pairs mentioned previously which nested closely together. In two of these nests remains of fawns made up the greater part of the food items found, ground squirrel being a less common prey item. In the third nest, remains of both ground squirrels and fawns were common, while the fourth pair fed almost entirely on ground squirrels, no fawn remains being found.

Such evidence of individual specialization is obscured when food habits data are lumped, as in the accompanying table.

PREY ITEMS RECORDED IN NESTS

Table 1 lists prey items found in the nests, by numbers of individuals of each species, percentage of total items recorded, and by date. In calculating percentages, no consideration of bulk difference was made, the percentage figures representing merely the number of prey items of each species in relation to the total number of prey items recorded. Figures in the column headed "Old remains (no date)" represent weathered bones that persisted in the nests from previous seasons. Remains of large animals would of course be more obvious than those of small prey. As a result these data are biased, but they constitute only a small part of the total record.

Mammals.—Two mammal species, the ground squirrel and jackrabbit, formed the majority of all prey items recorded. Within the study area there were notable local differences in the dominance of these species in the eagle diet, in some areas ground squirrels and in others jackrabbits prevailing. Generally speaking in the more northern portions of the study area the eagles nested in rugged, wooded areas (fig. 1), and hunt-

Table 1
Summary of Remains Found in Nests of 17 Pairs of Golden Eagles through Period of Study,
1947 to 1952

Prey species	March	April	May	June	Old remains (no date)	Total	Per cent
MAMMALS							
Jackrabbit (<i>Lepus californicus</i>)	2	52	71	7	12	144	28.6
Ground Squirrel (<i>Citellus beecheyi</i>)	1	70	59	2	1	133	26.4
Black-tailed Deer (<i>Odocoileus hemionus</i>)	....	6	34	9	15	64	12.7
Striped Skunk (<i>Mephitis mephitis</i>)	2	5	4	4	2	17	3.4
Gray Squirrel (<i>Sciurus californicus</i>)	....	6	1	....	....	7	1.4
Woodrat (<i>Neotoma fuscipes</i>)	....	....	4	....	....	4	.8
Domestic Cat (<i>Felis domesticus</i>)	....	1	2	....	1	4	.8
Pocket Gopher (<i>Thomomys bottae</i>)	1	2	....	....	....	3	.6
Weasel (<i>Mustela frenata</i>)	....	....	3	....	....	3	.6
Meadow Mouse (<i>Microtus californicus</i>)	....	....	3	....	....	3	.6
Opossum (<i>Didelphis virginiana</i>)	1	1	....	....	....	2	.4
Raccoon (<i>Procyon lotor</i>)	....	....	1	....	1	2	.4
Gray Fox (<i>Urocyon cinereoargenteus</i>)	....	1	....	....	....	1	.2
Mole (<i>Scapanus latimanus</i>)	....	....	1	....	....	1	.2
Cottontail Rabbit (<i>Sylvilagus audubonii</i>)	....	....	....	....	1	1	.2
						389	77.3
BIRDS							
Yellow-billed Magpie (<i>Pica nuttallii</i>)	....	3	25	2	....	30	5.9
Western Meadowlark (<i>Sturnella neglecta</i>)	....	3	3	2	....	8	1.6
Horned Owl (<i>Bubo virginianus</i>)	....	2	2	2	1	7	1.4
Valley Quail (<i>Lophortyx californica</i>)	....	1	3	....	....	4	.8
Crow (<i>Corvus brachyrhynchos</i>)	....	2	1	....	....	3	.6
Turkey Vulture (<i>Cathartes aura</i>)	....	....	....	2	1	3	.6
Roadrunner (<i>Geococcyx californicus</i>)	....	1	1	....	....	2	.4
Steller Jay (<i>Cyanocitta stelleri</i>)	....	....	....	2	....	2	.4
Mallard (<i>Anas platyrhynchos</i>)	....	....	....	1	1	2	.4
Scrub Jay (<i>Aphelocoma californica</i>)	....	....	....	1	....	1	.2
Sparrow Hawk (<i>Falco sparverius</i>)	....	....	....	1	....	1	.2
Red-shafted Flicker (<i>Colaptes cafer</i>)	....	....	1	....	....	1	.2
Barn Owl (<i>Tyto alba</i>)	....	....	1	....	....	1	.2
Lewis Woodpecker (<i>Asyndesmus lewis</i>)	....	1	....	....	....	1	.2
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	....	....	....	....	1	1	.2
Great Blue Heron (<i>Ardea herodias</i>)	....	....	....	....	1	1	.2
						68	13.5
REPTILES							
Gopher Snake (<i>Pituophis catenifer</i>)	....	6	9	10	1	26	5.2
Pacific Rattlesnake (<i>Crotalus viridis</i>)	....	....	1	....	....	1	.2
Common King Snake (<i>Lampropeltis getulus</i>)	....	....	1	....	....	1	.2
						28	5.6
FISH							
Sacramento Perch (<i>Archoplites interruptus</i>)	....	17	....	....	....	17	3.4
Sacramento Sucker (<i>Catostomus occidentalis</i>)	....	....	....	....	1	1	.2
						18	3.6
Totals						503	100.0

ing was primarily conducted over the open tops of prominent ridges. There ground squirrels were the principal prey. To the south, terrain was more open and rolling (fig. 2), with wide ridge tops and fields comprising the hunting areas, and there jackrabbits predominated in the eagle diet.

Similarly, the terrain appeared to be an important factor governing the utilization of black-tailed deer as a prey species. Remains of this species in nests were considerably more numerous in areas where the adults hunted over abrupt ridges and mountainous terrain. Remains were almost entirely of fawns, although on one occasion (May 8, 1951) a complete left forequarter of an adult deer was found in a nest (fig. 4). Remains of two stillborn fawns also were found, indicating scavenging. It is well known that Golden Eagles will utilize already dead prey, but to what extent carrion was represented in the materials of my study is impossible to say.



Fig. 3. Newly hatched young and egg of Golden Eagle, April 17, 1951. Visible food remains include one ground squirrel and one horned owl.

The occurrence of deer remains in nests raises the question of how much weight an eagle can lift. According to Richard D. Taber, weights of black-tail fawns during the period of predation by nesting eagles would be between 6 and 17 pounds. Although most of the fawns found were quite young, and consequently small, some larger ones were brought to the nests late in the nesting period (figs. 4 and 5). Delivery would be facilitated by the fact that the ridge tops hunted by the eagles frequently were above the nest sites, and a fawn might be taken to a nest by a glide rather than by actual lifting of prey and flying up to a nest. Further, there is some evidence that at least in the cases of larger prey species, portions are eaten by the adults before the item is brought to the nest. In observed kills adults spent much time with the prey before taking it to the nest. Large prey species were most frequently represented in the nest by hindquarters rather than by remains of entire carcasses.

Of the remaining larger mammals, the four domestic cats recorded were apparently

all full grown when taken, but the gray fox and the two raccoons were young individuals. Remains of both adult and young skunks and opossums were found.

Birds.—Of the 30 Yellow-billed Magpies found in the nests, the majority were young birds, apparently just fledged. In at least two instances, however, remains were found of young magpies that were too young to have left the nest. Two groups of six and eight unfledged young were found in two eagle nests in northern Santa Clara County on



Fig. 4. Young approximately 28 days old, May 8, 1951. Food remains include one jack-rabbit, parts of five fawns, and left foreleg of adult deer (left center).

May 8 and 12, 1951, respectively (fig. 5). Individuals of each group were in graduated stages of development.

The majority of the remains of seven Horned Owls were of adults (fig. 3). However, two half-eaten, downy young were found in one eagle nest on June 2, 1951.

Remains of two of the three Turkey Vultures recorded were from adult birds. The third was identified only from skeletal material and age was not determined.

Mallards nest regularly near both nests in which remains of this species were found. One of the two Mallards recorded was a female while the sex of the other was not determined (identification was made only from fragmentary skeletal remains).

Reptiles.—Twenty-six gopher snakes formed the bulk of the reptile remains. Most of these were adults. In a majority of cases the remains were of almost the entire snake, few being more than a third eaten. On one occasion late in a nesting season (June 14, 1951), seven untouched gopher snakes, only one of which was less than three feet in length, were found in one nest (see fig. 6).



Fig. 5. Young approximately 40 days old, May 8, 1951. Food remains include six young magpies (lower center), one rattlesnake (lower right), and parts of four fawns (right center).

The remains of the one Pacific rattlesnake recorded seemed to be from an individual approximately three feet in length, the anterior third of which was missing and presumably had been eaten (fig. 5). Only a small section of the one king snake, estimated to be two feet in length, was found.

Fish.—Remains of fish were found at only two of the nests. Beneath one of these were recovered the left operculum and right cleithrum of a Sacramento sucker approximately 15 inches in length. Identification was made by Dr. W. I. Follett, Curator of Fishes, California Academy of Sciences.

Remains of 17 Sacramento perch were found during a number of visits to the second nest. These remains were from fish averaging 10 inches in length and were for the most part only partially eaten.

The two nests where fish remains were found were only a few thousand yards apart and were located in the vicinity of a lake which evidently served as a source of such food items.

Other records of North American Golden Eagles utilizing fish as a food item are unknown to the writer.

FOOD OF THE ADULTS

During the period when the young eagles are in the nests, the food eaten by the adults appears to be of the same species, and very often the same individuals, as are brought to the young. The fact that adults often consume parts of large prey items before bringing the remains to the nest has been mentioned. In instances during which adults were observed feeding young, the adults freely ate from the carcass from which

they fed the young. Contents of adult pellets found in the nests before the young were large enough to produce comparable pellets did not differ materially from fresh prey remains found in the nests.

Twelve food items were found during eight visits to six nests before the eggs had hatched. Species of such food items were of the same species as were commonly found in the same nests during the first month after the eggs had hatched.



Fig. 6. Young approximately 65 days old, June 14, 1951. Food remains include seven gopher snakes.

DISCUSSION

The literature of North American ornithology contains numerous references to the food of the Golden Eagle. For the most part, however, these are in the form of brief notes on the contents of single nests or a few stomachs, or observation of an occasional kill. May (1935) and Bent (1937) summarize a number of these, together with several more extensive works, to present collective reviews of what had appeared in the literature up to the mid-1930's. More recently, E. P. Pister (MS, 1950) reviewed and summarized some 94 papers on the subject. Nearly all writers concur that Golden Eagles take a wide diversity of prey species, but in all localities the bulk of the diet consists of a few predominant mammalian species such as the ground squirrel, prairie dog, and/or jackrabbit. In some instances, such as in the present study, game species or livestock may form a significant portion of the diet. Woodgerd (1952) found pronghorn antelope remains in 15.7 per cent of 51 eagle stomachs obtained in Montana. At the same time,

however, he found jackrabbits in 56.9 per cent of these stomachs. Buechner (1950) noted predation on domestic sheep and antelope in the Trans-Pecos region of Texas.

At times some control measures may become necessary when the food habits of the eagle oppose the interests of man. However, predation upon a game species does not necessarily indicate detrimental repercussions in the game population nor does the mere presence of a population of eagles in the vicinity of game or livestock indicate that such are preyed upon by the eagles. Murie (1944) found eagles abundant in an area supporting a sizeable population of Dall sheep and yet the latter species was represented in only 2.4 per cent of 632 eagle pellets examined. Ground squirrels were found in 86 per cent of these pellets.

In the present study area, the black-tailed deer is very abundant despite predation by eagles and mammalian predators as well. In fact, hunting and predation seem to be removing less than the annual increase in the herds as judged from the periodic disease losses stemming from malnutrition and excessive competition (Longhurst *et al.*, 1951). Such removal of fawns as can be charged to the eagles is probably a distinct benefit to the deer.

SUMMARY

Observations of food remains found in the nests of 17 pairs of Golden Eagles in the interior central coast ranges of California, from 1947 to 1952, are summarized. In the area studied, the Golden Eagle is a fairly common raptorial species. Nests were visited sporadically at first, but in later stages of the study visits were made from five days to two weeks apart. Remains were removed from the nests to prevent possible recount.

During the nesting period, eagles in the region studied bring to their young a wide variety of food items, dominated, however, by ground squirrels and jackrabbits. Black-tailed deer, mostly fawns, were extensively utilized by some pairs. Mammals collectively made up 77.3 per cent of the diet. Among the birds, which constituted 13.5 per cent of the diet, the Yellow-billed Magpie was the principal prey. A few snakes and fish completed the list of items found in the nests.

Comparison of these findings with other observations recorded in the literature indicates that the normal diet of the Golden Eagle consists principally of mammals, mostly non-game species.

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Museum of Vertebrate Zoology, University of California, Berkeley, September 15, 1953.

THE OCCURRENCE AND MAINTENANCE OF THE REFRACTORY PERIOD
IN CROWNED SPARROWS

By ALDEN H. MILLER

The inability to maintain a breeding condition indefinitely has led to the recognition of a state of refractoriness or of a requirement for rest and inactivity before resumption of breeding. Refractoriness has been reported in birds of several species; the phenomenon is fairly well known, for example, in Starlings (Burger, 1949), English Sparrows (Riley, 1936), Slate-colored Juncos (Wolfson, 1952a, 1952b) and Golden-crowned Sparrows (Miller, 1948). Refractoriness is demonstrated by experimental treatment with light of amounts that under other circumstances would induce gonad development. The failure to stimulate gonad activity has two aspects: (1) the gonads will regress from a breeding state under prolonged treatment with long daily light periods (Burger, 1949; Wolfson, 1952b); and (2) inactive birds that have attained the regressed state, naturally or by experimentation, may fail to respond to light stimulation if they have not been inactive long enough. More extended reviews of these matters are to be found in the recent papers just cited.

In the work with Golden-crowned Sparrows (*Zonotrichia coronata*) thus far reported (Miller, 1948, 1949, 1951), it was shown that normal autumnal refractoriness of adults and immatures persists through October and until about November 5. This is true whether gradual light increases or sudden heavy light dosages are given before this date. Once having been put on a long light-day in the refractory period, this species thereafter remains refractory, at least until mid-spring. This sustained refractory condition would seem to be explicable in two ways: (1) the experimental birds become accustomed to long days, or are conditioned to them, during their normal refractory period and require a further increased dose of light to stimulate them to respond; or (2) the birds under constant stimulation prolong a fatigue of the pituitary-gonad mechanism so that response is indefinitely postponed. This second line of explanation was suggested by Burger (1949:223).

To test these alternate hypotheses, an experiment was set up in 1951 designed to rule out or substantiate the first proposition. At the same time it was possible in the seasons of 1951-52, and also in 1950-51, further to document the presence of the normal refractory period and to demonstrate even greater experimental prolongation of it into late spring and summer. A further purpose of the experiments in these two years was to develop parallel data on the closely related White-crowned Sparrow (*Zonotrichia leucophrys*) and to determine the histological condition of the testes in the experimental birds and compare it with the normal histological cycle so extensively analyzed in this species by Blanchard (1941) and Blanchard and Erickson (1949).

EXPERIMENTS

As in earlier experiments (Miller, 1948), control and experimental birds were kept in adjoining outdoor screened cages, 8×8×7 feet, at Berkeley, California. The controls were shielded from the experimental cage so that they slept on their roosts while artificial light was being given to the experimentals. The sparrows were trapped in early and mid-October soon after arrival in Berkeley from their northern breeding grounds; a few examples of the locally resident race of White-crowned Sparrow (*Z. l. nuttalli*) were trapped at this time and also were used in the experiments. The type of light added and the water and food supplies were the same as in previous experiments.

1950-51. The experiment in this season was begun on October 24 with a sudden change to a constant 15½ hour light-day. Experimental birds carried through to a point

of significant results included 6 male Golden-crowned Sparrows and 10 male White-crowned Sparrows, the latter being of the following racial types: *Z. l. gambelii*, 3; *pugetensis*, 4; *nutalli*, 1; *pugetensis-nuttalli* intergrades or intermediates, 2. No controls of the Golden-crown were maintained, as data from earlier years were available as adequate control material. Six White-crowns were maintained as controls, consisting of the following races: *gambelii*, 3; *pugetensis*, 2; *nutalli*, 1. The Golden-crowns were held on the constant light treatment through spring and summer, the birds being sacrificed at intervals from May 24 to August 31, 1951. The White-crowns in the same experimental cage were autopsied from December 31 to May 24; the controls were autopsied from March 4 to May 24.

1951-52. The experiment again was initiated on October 24 with a 15½ hour light-day, but on January 10 the day length was increased to and maintained at 21 hours, thus providing a substantial additional light stimulus to test the hypothesis concerning need of augmented stimulation to overcome refractoriness. At the time of this light increase some birds were moved from the control cage to the experimental cage and thus were switched from normal short winter days to extremely long days after the expected termination of the refractory period. These are referred to subsequently as experimentals of type II contrasted with the initial experimentals, type I. Experimentals of type I maintained to date of autopsy consisted of 4 male Golden-crowned Sparrows and 6 male White-crowned Sparrows of the following races: *pugetensis*, 4; *nutalli*, 1; *pugetensis-nuttalli*, 1. Experimentals of type II consisted of 3 male Golden-crowns. Controls consisted of 3 male Golden-crowns; no control White-crowns were maintained, as data on controls from the previous year were fairly adequate. The experiment was concluded and most of the birds were autopsied on March 25, except that one experimental type I Golden-crown and one experimental type I White-crown were maintained until July 13, the artificial lighting on them being terminated on March 25 so that they reverted at that time to a normal 13-hour day from 21 hours and experienced a normal gradual increase thereafter to the summer solstice level of about 16 hours of daylight.

RESULTS

In 1951-52, the experimentals of type I that had been started at 15½ hours in the known refractory period, and which were given additional light beginning in January, showed no gonad enlargement on March 25 (see table 1). Three Golden-crowns and 3 White-crowns were autopsied at this time. There was an ample interval since January 10 for the increased light to have stimulated recrudescence. In other words, the refractory state was fully maintained. At the same time the experimentals of type II, 3 Golden-crowns, in the same cage but introduced to the 21-hour day directly from a regime of normal short winter days in January, showed spectacular recrudescence (table 1); one had even attained a testis development approaching that of full breeding condition. Control Golden-crowns on this same date were beginning to show slight but significant advances in line with normal gonad recrudescence (table 1, fig. 1).

The results bearing on extreme prolongation of refractoriness were obtained in the experimentals of 1950-51. Golden-crowns autopsied on June 30, August 1, and August 31 were still at winter minimum gonad size and had remained refractory in the latter instance for essentially a full year from the time the bird must have left its breeding ground in a quiescent condition. In the White-crowns in this same year the refractory period was extended to May 24 when the last were autopsied. The two sacrificed on this date represent the races *nutalli* and *pugetensis*, both of which races were at the height of breeding condition in the wild at this time. All the experimentals with the exception of one were at winter minimum condition. The exception, a White-crown of the race

Table 1

Data on Experimental and Control Male Crowned Sparrows

Identity	Age at beginning of experiment	Date autopsied	Duration of light treatment in days	Day length in hours and beginning date of treatment	Volume of left testis in mm. ³	Fat condition***	Histologic stage****
<i>Z. coronata</i>	?	May 24, 1951	212	15½ (Oct. 24)	0.34	heavy	1-2
<i>Z. coronata</i>	?	June 30, 1951	248	15½ (Oct. 24)	0.50	heavy	2
<i>Z. coronata</i>	?	June 30, 1951	248	15½ (Oct. 24)	0.25	little	2
<i>Z. coronata</i>	?	Aug. 1, 1951	280	15½ (Oct. 24)	0.88	medium	2d
<i>Z. coronata</i>	?	Aug. 1, 1951	280	15½ (Oct. 24)	0.37	little	2
<i>Z. coronata</i>	?	Aug. 31, 1951	310	15½ (Oct. 24)	0.44	none	2
<i>Z. coronata</i>	im.	Mar. 25, 1952	152(I*)	15½-21 (10/24; 1/10)	0.46	none	2
<i>Z. coronata</i>	ad.	Mar. 25, 1952	152(I)	15½-21 (10/24; 1/10)	0.57	none	2
<i>Z. coronata</i>	im.	Mar. 25, 1952	152(I)	15½-21 (10/24; 1/10)	0.58	none	2d
<i>Z. coronata</i>	ad.	July 13, 1952	152(I)	15½-21—normal (10/24; 1/10; 3/25)	0.78	none	2d
<i>Z. coronata</i>	ad.	Mar. 25, 1952	74(II)	21 (Jan. 10)	6.68	none	4
<i>Z. coronata</i>	im.	Mar. 25, 1952	74(II)	21 (Jan. 10)	38.67	medium	5-6
<i>Z. coronata</i>	ad.	Mar. 25, 1952	74(II)	21 (Jan. 10)	85.67	little	6+
<i>Z. coronata</i>	ad.	Mar. 25, 1952	control	normal variable	0.99	little	3
<i>Z. coronata</i>	ad.	Mar. 25, 1952	control	normal variable	3.96	little	3+
<i>Z. coronata</i>	ad.	July 13, 1952	control	normal variable	222.52	medium	7
<i>Z. l. gambelii</i>	im.	Dec. 24, 1945	75	**→15½ (Oct. 10)	0.26	none	?
<i>Z. l.</i>	im.	Mar. 31, 1946	172	→15½ (Oct. 10)	0.28	little	?
<i>Z. l. pugetensis</i>	im.	Jan. 16, 1948	72	→14½ (Nov. 5)	121.89	little	?
<i>Z. l. pugetensis</i>	im.	Feb. 15, 1948	102	→14½ (Nov. 5)	146.15	medium	?
<i>Z. l. pugetensis</i>	ad.	Feb. 15, 1948	102	→14½ (Nov. 5)	150.15	heavy	?
<i>Z. l. pugetensis</i>	im.	Feb. 2, 1950	101	15½ (Oct. 24)	0.40	none	2
<i>Z. l. gambelii</i>	ad.	Dec. 31, 1950	68	15½ (Oct. 24)	0.63	little	1
<i>Z. l. pugetensis</i>	ad.	Dec. 31, 1950	68	15½ (Oct. 24)	0.54	none	2
<i>Z. l. pug.-nutt.</i>	ad.	Mar. 4, 1951	122	15½ (Oct. 24)	0.37	none	2
<i>Z. l. gambelii</i>	ad.	Mar. 4, 1951	122	15½ (Oct. 24)	1.31	little	2
<i>Z. l. gambelii</i>	?	Apr. 18, 1951	167	15½ (Oct. 24)	0.94	medium	1-2
<i>Z. l. pug. nutt.</i>	ad.	Apr. 18, 1951	167	15½ (Oct. 24)	1.05	medium	2
<i>Z. l. pugetensis</i>	ad.	Apr. 18, 1951	167	15½ (Oct. 24)	2.15	none	2d
<i>Z. l. pugetensis</i>	?	Apr. 18, 1951	167	15½ (Oct. 24)	170.81	medium	7
<i>Z. l. pugetensis</i>	?	May 24, 1951	203	15½ (Oct. 24)	0.25	medium	2
<i>Z. l. nuttalli</i>	?	May 24, 1951	203	15½ (Oct. 24)	0.46	little	1-2
<i>Z. l. pugetensis</i>	ad.	Jan. 10, 1952	78	15½ (Oct. 24)	0.47	none	1
<i>Z. l. pugetensis</i>	ad.	Jan. 10, 1952	78	15½ (Oct. 24)	0.50	none	2
<i>Z. l. pugetensis</i>	im.	Mar. 25, 1952	152(I)	15½-21 (10/24; 1/10)	0.73	none	2
<i>Z. l. nuttalli</i>	im.	Mar. 25, 1952	152(I)	15½-21 (10/24; 1/10)	0.82	none	2
<i>Z. l. pugetensis</i>	ad.	Mar. 25, 1952	152(I)	15½-21 (10/24; 1/10)	1.21	none	2
<i>Z. l. pug.-nutt.</i>	im.	July 13, 1952	152(I)	15½-21—normal (10/24; 1/10; 3/25)	158.80	medium	7
<i>Z. l. gambelii</i>	ad.	Mar. 4, 1951	control	normal variable	0.90	little	3
<i>Z. l. pugetensis</i>	ad.	Mar. 4, 1951	control	normal variable	2.81	little	4
<i>Z. l. gambelii</i>	?	Apr. 18, 1951	control	normal variable	6.63	heavy	4
<i>Z. l. pugetensis</i>	?	Apr. 18, 1951	control	normal variable	41.04	heavy	6
<i>Z. l. gambelii</i>	?	May 24, 1951	control	normal variable	180.91	heavy	7
<i>Z. l. nuttalli</i>	?	May 24, 1951	control	normal variable	199.00	heavy	7

* I signifies experimental of type I, see text.

** → signifies day length gradually increased to this figure; date is the beginning of light increase.

*** Fat categories as designated by Wolfson (1945:109).

**** Histologic stages as described and figured by Blanchard (1941) and Blanchard and Erickson (1949);

"d" signifies some indication of degenerating spermatogonia.

pugetensis taken on April 18, was in full breeding condition. Two lines of explanation may be offered for such unexpected results. First, the date of ending of the natural refractory period in White-crowns is apparently a little earlier than in Golden-crowns and hence the onset of light treatment on October 24 may have found this individual reactive whereas others were not. Golden-crowns previously were found to be individually variable with respect to refractoriness on November 5. Second, power failures in mid-winter of 2 to 3 day's duration may have broken the light treatment long enough for this exceptional White-crown to react. This second possibility seems rather unlikely, however, as no other experimentals showed effects of such interruption.

Concerning refractoriness in White-crowns in general, it can be stated that experimentals (17 specimens), regardless of race, show refractoriness (see table 1) as in the Golden-crowned Sparrow. In other words, there is a period in the fall when added light does not lead to recrudescence and the refractoriness is maintained under continual light treatment. However, three White-crowns started on gradual light increments on November 5 in 1947 showed no refractoriness in contrast to some Golden-crowns in the same cage. These White-crowns attained full breeding condition by mid-February or earlier, at least three months in advance of the norm for the race *pugetensis* to which they belonged. Wolfson (1945:98) had reported earlier that White-crowns to which he had given light increments beginning on October 18 showed recrudescence. This result contrasts with that for two birds to which I gave similar treatment beginning on October 10 and which showed refractoriness, and with a considerable number that were given suddenly augmented light-days of 15½ hours beginning on October 24 and which also were refractory. Wolfson's birds were receiving only 13 hours by October 24 even though increases started a week earlier. The results therefore seem not inconsistent and point to a termination of refractoriness in this species definitely before November 5, with a variable response to be expected in the last 10 days of October, depending on individual differences and perhaps on the amount of light increment in this transitional period. The exceptional responsive bird referred to earlier fits in with this concept.

The data for all years are reviewed in figure 1. The graphing of gonad size follows the plan used earlier in which the volume of the left testis is plotted as its cube root in order to provide a convenient scale. Detailed tabulation of results on Golden-crowns of earlier years (Miller, 1948, 1951) is not repeated but supplementary data since 1949-50 are given in table 1 as well as all data on White-crowns.

The two individuals, one of each species, that were given special treatment in 1951-52, namely artificial light to March 25 and normal day lengths thereafter, sustained refractoriness until March 25 in so far as all external signs indicated. On July 13 the Golden-crown given this treatment was autopsied and was found still to be at winter minimum state. The shortening of the days to 13 hours in March evidently was not sufficient to break its refractoriness. The White-crown, on the other hand, had by July 13 developed to full breeding condition and was moderately fat. Possibly it had failed to be refractory initially, but more likely the drop from 21 hours to 13 hours of light in March was sufficient to break the refractoriness at that time. On March 25 it had shown no fat and was undergoing a complete molt of body, wing, and tail feathers, almost certainly indications in this species of inactive or regressing gonads. These two birds autopsied in July are inadequate in number to demonstrate the effect of the particular light regime involved, especially since they showed opposite responses. However, the sustained refractoriness of the Golden-crown suggests in conjunction with results on the other experimental groups of this species that there is need for a period of a month or more at 13 hours or less of light daily in order to overcome refractoriness.

The results with respect to subcutaneous fat condition are indicated in the table.

In general, the controls show the normal fat conditions correlated with the gonad cycle in which little or no fat is present in winter when the gonads are small, and in which heavy, or at least medium, amounts of fat appear during recrudescence. At the height of breeding condition in the wild, fat is absent in males, but in captive birds held under conditions where they can not actually breed this may not be true. Refractory birds usually show no large fat deposits even when refractoriness is prolonged. However, some exceptions will be noted in table 1. The results in such experimental individuals are thus

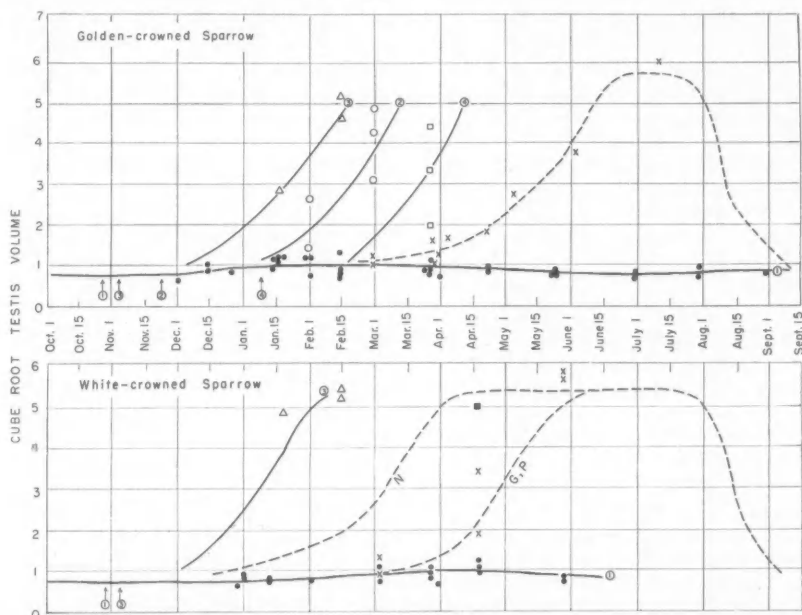


Fig. 1. Testis volume in experimental and control crowned sparrows. Solid dots indicate refractory experimental birds of all years; solid lines marked "1" at right end represent averages for refractory birds. Controls shown by "X's" and by broken lines; lines are drawn partly from general information on normal breeding seasons and from data on *Z. leucophrys* of Blanchard and Erickson; N represents race *Z. l. nuttalli*, G, P, races *gambellii* and *pugetensis*. Triangles and line 3 represent responsive experimentals of 1947-48; open circles and line 2, responsive experimentals of 1946-47; open squares and line 4, experimentals of type II of 1951-52; solid square, single abnormally responsive experimental of 1950-51. Arrows mark onset of light treatment for groups of corresponding number.

more erratic with respect to fat response than Wolfson (1952b) reports in experimental State-colored Juncos showing refractoriness. But it should be noted that his birds were kept in indoor cages with little temperature fluctuation whereas mine were experiencing normal daily and seasonal variations in temperature, a situation in which thyroid activity may be influenced in part independently of pituitary control.

The histological condition of the gonads of all experimentals and controls has been checked beginning with the season of 1949-50. The preparations were made from Bouin's fixations, were sectioned at 7 μ and were stained with Harris haematoxylin and

eosin B. The material thus is comparable to that analyzed by Blanchard (1941) and Blanchard and Erickson (1949). In the examples of *Zonotrichia coronata* of 1949-50 as in the subsequent material on this species and on *Zonotrichia leucophrys*, all birds showing refractoriness as indicated by persistent small gonad size failed to show histological developments beyond stage 2 of Blanchard. Stage 2 is distinguished from stage 1, the condition of complete quiescence of the autumnal and winter period, by the appearance of a few Leydig cells in the interstitium. Rarely have I found a bird that seemed to have no Leydig cells or at least no partly enlarged and rounded cells in what we suppose is progression toward functional condition. The distinction, then, between stages 1 and 2 is a tenuous one and possibly is not useful as Wolfson (1952b) has suggested. However, I can distinguish borderline or doubtful stage 2 gonads with only rare, small Leydig cells as against others with varying numbers of well rounded Leydig cells that clearly qualify as Blanchard and Erickson's stage 2. In the table, particularly early or dubious examples of stage 2 are indicated as "1-2." Through the technique used I am unable to distinguish differences in the lipoidal content coincident with the enlargement of the Leydig cells from immature or precursor cells as Marshall (1951) has undertaken to do.

The significant histological observations in connection with the experiments are, then, that no refractory bird progresses to stage 3, in which Leydig cells are common and primary spermatocytes appear, and that nearly all such birds do develop some well formed Leydig cells. Thus they just begin the process of recrudescence, if we follow the interpretation of Blanchard and Erickson (1949), but become arrested at this point.

An occasional refractory bird, those marked with a "d" in the table, shows a stage 2 condition but has a noticeable mass of degenerating spermatogonia in the tubule. This suggests that some spermatogonia produced in stage 2 having failed to proceed to the primary spermatocyte stage are being resorbed. These degenerating cells give no sign of having been more advanced types of sex cells; their appearance is quite different from that of the mass of sperm debris and spermatids to be seen in stages of regression following breeding.

The responsive birds (experimentals of type II, especially) and the controls show the expected progress toward the full breeding condition of stage 7 according to date and history of light stimulus.

In the earlier experiments (Miller, 1948) it was shown that prenuptial molt in experimental refractory birds is irregularly manifest and is certainly not fully repressed, although repression might be expected. Some degree of independence of the molt control and the light-pituitary-gonad mechanism was thereby suggested. In the later experiments, molt also has been irregular in amount and timing and hence is not reported in detail. In general the later observations support the earlier suggestion. However, it was noted that some birds of both species autopsied on March 25—individuals that had been and were refractory—were molting more completely than in a prenuptial molt; rectrices and remiges were being replaced as in a postbreeding or annual molt. Such a molt of course occurs normally when the gonads are regressed or in process thereof in a normally occurring refractory period in late summer.

DISCUSSION AND CONCLUSIONS

The prolongation of refractoriness appears to be due to constant fatigue of the response mechanism from light stimulation and not the result of conditioning the birds to a given light program such that further light increments would be needed to break the refractoriness. Apparently Golden-crowned Sparrows and White-crowned Sparrows started on 15½-hour days in the autumn have not had sufficient rest under a short light-day regime to overcome fatigue. They therefore fail initially and subsequently to recover

responsiveness. These conclusions are in general agreement with Wolfson's finding (1952*b*) on Slate-colored Juncos and with his interpretations. In the crowned sparrows dealt with by me, the prolongation of refractoriness was extended to 203 days in the White-crown and to 310 days in the Golden-crown. There was no sign that it could not be extended even further beyond the experimentally determined limits. In the Golden-crown, this extension means that refractoriness was prolonged through and beyond the time of normal breeding, to the end of August, when natural populations would have arrived at a second, or subsequent, normal refractory period.

In crowned sparrows of both species, immatures as well as adults show autumnal refractoriness. The immatures display no differences in schedule nor in susceptibility to prolongation of refractoriness compared with the adults. This is significant for the reason that the immatures cannot be in need of rest or recovery from a period of previous gonadal activity, since they have never bred; their maturation of the pituitary-gonad mechanism has not proceeded far enough, apparently, so that they can respond properly, and, once fatigued by premature stimulation, the mechanism fails to respond indefinitely as in the adults. Wolfson (1952*b*) also has found immatures refractory in the Slate-colored Junco but apparently overlooked (p. 321) the fact that it had been reported earlier in the Golden-crown. The absence or restricted duration of refractoriness in immatures of the English Sparrow (Davis, 1953) constitutes a notably contrasting situation.

In the refractory condition, the gonads show in both species of crowned sparrow a small number of Leydig cells, most individuals thus progressing to histologic stage 2 of Blanchard. At this point, however, recrudescence is stopped. It may be, as suggested earlier (Miller, 1951), that the few Leydig cells of stage 2 indicate a low level of stimulation from gonadotropins from the pituitary and in a sense a capability of the pituitary-gonad mechanism to respond. In the light of the later experimental evidence it merely appears that fatigue from overstimulation, presumably of the pituitary (see Miller, 1949), halts a further response. Bailey (1950) has shown experimentally that injection of prolactin of the pituitary is capable of blocking the gonadotropins of the pituitary and thus producing refractoriness to light stimulation. Whether prolactin naturally delivered to the blood stream is actually a factor in regulating and prolonging refractoriness in the birds herewith reported on, is of course unknown. If so, it is not easy to understand why the pituitary should produce excessive amounts of prolactin such as to block its own gonadotropins under the experimental conditions prevailing.

In the experiments conducted in 1950-51 and 1951-52 further data were accumulated to substantiate the time of occurrence of normal refractoriness in the fall. In the Golden-crown this normal period ends about November 5 and at this date shows, as might be expected, some individual variation. It is now shown that the natural termination point in White-crowned Sparrows, of at least two migratory races, comes slightly earlier, in the last week of October.

The experiments with White-crowned Sparrows, in which species the normal cycle has been so fully studied, show that, except for the slight difference in termination date of autumnal refractoriness, the response and the histological conditions are identical with those of the Golden-crown. In both species there is no ability as a consequence of purely inherent forces or rhythms to overcome the effects of an unusual light regime. Apparently internal rhythm in adults in these species in the pituitary-gonad mechanism is to be regarded as in part an inherent need for rest following prolonged activity, such rest to be derived from a period of short light-days as in Slate-colored Juncos. Whether or not an inherent tendency to resume activity after rest would proceed in the absence of normal light-days, that is, on a prolonged regime of winter-length days, is yet to be

shown. Certainly resumption is initiated earlier than normal and is accelerated by adding light. As Wolfson (1952a:196) has suggested chiefly from work on juncos, internal rhythm is probably only an attribute which requires alternation of processes. The timing of these processes and their amplitude, in their many aspects, seem to be controlled in large measure by day length.

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BIRDS OF THE BARRANCA DE COBRÉ REGION OF SOUTHWESTERN CHIHUAHUA, MEXICO

By KENNETH E. STAGER

In the period from May 7 to May 30, 1950, an ornithological expedition from the Los Angeles County Museum, sponsored and led by Mr. William J. Sheffler, conducted field work in southwestern Chihuahua, México. Mr. Sheffler has long held a very active interest in the ornithology of northwestern México, and this particular expedition is but one of many field programs sponsored by him in the western states of México. The Los Angeles County Museum is very grateful for being allowed to join Mr. Sheffler in this particular investigation.

The purpose of the field work on this occasion was to further the knowledge of the distribution and movement of bird life through the great barranca, or canyon region, of the Sierra Madre Occidental. This large mountain chain rises gently on its east flank but drops off rapidly on the west. The region of the Sonora-Chihuahua-Sinaloa boundary is a highly eroded area made up of a network of large canyons or barrancas. Each of these attains a depth of several thousand feet. The three principal barrancas of this network are the Barranca de Chínipas, Barranca de Batopilas, and the Barranca de Cobre. All three canyons are river formed and their streams drain westward as tributaries of the Río Fuerte which empties into the Gulf of California in extreme northwestern Sinaloa.

The Barranca de Cobre, which was the selected terminus of the expedition, is the largest of the three canyons. We approached the barranca from the southwest, having changed from motor vehicles to pack train at Rancho Guirocoba in the southeastern corner of the State of Sonora. The initial route of the pack train was through northern Sinaloa in order to bypass the mountain mass immediately to the northeast of Rancho Guirocoba. At a point where the Barranca de Chínipas makes its confluence with the Río Fuerte, the pack train turned northeastward and crossed into the State of Chihuahua on May 7, 1950, at the small border village of Tierras Coloradas, 4000 feet. From this point we continued generally northeastward toward the Barranca de Cobre, arriving on the west rim of the canyon (8200 feet) on May 13, 1950.

This route led through various collecting localities in Chihuahua, which are listed in order of visiting as follows: Naranjo, Metate, El Muerto, Cusáraga, Arroyo Hondo, Refugio, Baqueré, Cerocahui, El Cajón and finally Cumbre, on the canyon rim.

The vegetative pattern of the country traversed begins with oak-covered ridges and canyons at Tierras Coloradas and gradually changes to light and then heavy mixings of pine and oak at the higher elevations. Arid tropical vegetation was encountered at one point along the transect where the trail drops down to Naranjo, 2650 feet, in the deep Arroyo Guachero. The forest cover of the west rim of the Barranca de Cobre consists chiefly of Chihuahua pine (*Pinus chihuahuana*) and Lumholtz pine (*Pinus lumholtzii*) with some fir and oak. The most interesting area of faunal and floral associations is the great canyon itself, for here on the steep slopes that descend to great depths is found a sharply delineated stratification of plant life with a characteristic avifauna for each association.

In past references to the Barranca de Cobre various observers have been inclined to exaggerate its depth. Our instruments indicated an elevation of 8200 feet at the base camp at Cumbre on the west rim, and 2900 feet at the river edge in the canyon bottom. Thus the canyon is over a mile in depth and is comparable in size to the Grand Canyon of Arizona. No instrument survey was attempted to determine the width of the Barranca from rim to rim. The general opinion is that it reaches a width of twenty miles

at some points and narrows to five miles at others. The Barranca de Cobre is shorter than the Grand Canyon, having a length of slightly over a hundred miles compared to a length of over two hundred miles for the Grand Canyon.

From the west rim at 8200 feet to the 6000 foot level, the slopes of the canyon are covered with a fairly heavy pine forest. At 6000 feet the pines give way rapidly to large oaks which in turn thin out and become smaller in size as the lower elevations are reached. At 4300 feet the first traces of the thorny and deciduous arid tropical plants are observed and at 4000 feet the first giant pitahaya cactus (*Lemaireocereus montanus*) are encountered. From this point down into the very bottom of the canyon, the slopes are covered with plants typical of the arid tropical association.

Although changes corresponding to those noted for the vegetation were evident in the avian population and certain species were found to be restricted to definite altitudinal zones, a few forms were found to move quite freely from one plant association to another. Some examples of the stratification of bird life on the slopes of the barranca are as follows:

Pine-oak 8200-6000 feet	Oak 6000-4300 feet	Arid tropical 4300-2900 feet
<i>Columba fasciata</i>	<i>Amazona finschi</i> †	<i>Heterocnus mexicanus</i>
<i>Rhynchopsitta pachyrhyncha</i>	<i>Otus tricapitis</i>	<i>Coragyps atratus</i>
<i>Otus flammeolus</i>	<i>Lampornis clemenciae</i> *	<i>Buteogallus anthracinus</i>
<i>Glaucidium gnoma</i>	<i>Colaptes cafer</i> *	<i>Caracara cheriway</i>
<i>Trogon mexicanus</i>	<i>Balanosphyra formicivora</i> *	<i>Scardafella inca</i>
<i>Cyanocitta stelleri</i>	<i>Dendrocopos arizonae</i>	<i>Leptoptila verreauxi</i>
<i>Parus sclateri</i>	<i>Aphelocoma ultramarina</i> *	<i>Ara militaris</i>
<i>Turdus migratorius</i>	<i>Myadestes obscurus</i>	<i>Piaya cayana</i>
<i>Sialia sialis</i>	<i>Icterus wagleri</i>	<i>Amazilia beryllina</i>
<i>Setophaga picta</i>	<i>Pipilo fuscus</i>	<i>Momotus mexicanus</i>
<i>Loxia curvirostra</i>		<i>Centurus uropygialis</i>
<i>Junco phaeonotus</i>		<i>Calocitta coliei</i>
		<i>Thryothorus sinaloa</i>
		<i>Polioptila nigriceps</i>
		<i>Basileuterus rufifrons</i>
		<i>Richmondia cardinalis</i>

† Ranges downward into arid tropical.

* Ranges upward into pine-oak.

The occurrence of arid tropical plant growth along the bottom of the Barranca de Cobre, in Chihuahua, provides an interesting ecological condition wherein an arid tropical avifauna is able to extend itself far northward into the heart of the Sierra Madre Occidental. This long tropical corridor is surrounded on both sides by plant associations of pine and fir with their corresponding avifaunas.

The avian use of this deep corridor has been indicated by Moore (Condor, 40, 1938: 23-28) when he suggests that the Barranca de Cobre may provide a means whereby a species such as the Black-capped Vireo (*Vireo atricapillus*) is able to cross the Sierra Madre Occidental in its southward migration to wintering grounds on the arid tropical plains of the Sinaloan coast. By using the deep canyon troughs as migratory flyways, Moore believes that the species resident in the south-central United States can travel to and from Sinaloa without having to climb over the Sierra Madre proper. Black-capped Vireos are common on the coastal plains of Sinaloa in winter and the canyon-flyway theory may be the explanation of this phenomenon. In so far as is known, however, *Vireo atricapillus* has yet to be observed or collected in the Barranca de Cobre. We were especially watchful for migrants in the canyon bottom, but found only western forms such as *Piranga ludoviciana*, *Chlorura chlorura* and *Hylocichla ustulata*. It is entirely pos-

sible, however, that our observations in the canyon bottom between May 17 and May 20, 1950, were too late to detect the migration of the Black-capped Vireo.

The rugged terrain of southwestern Chihuahua has been visited by few ornithologists and it is felt that the work of those preceding our activities are worthy of note. McLeod (van Rossem, Bull. Mus. Comp. Zool., 77, 1934:424-490), although primarily engaged in mining activities, collected worthwhile bird material from time to time through the years 1883 to 1885, inclusive. His itinerary in southwestern Chihuahua included the localities of Moris, Pinos Altos, Jesus Maria, Carmen, La Trompa, and Durazno. Frazar



Fig. 1. Barranca de Cobre from west rim near Cumbre, looking north.

followed McLeod and worked in the Pinos Altos area from June 2 to July 15, 1888, and at Bravo from July 18 to August 11 of the same year.

The first record of fieldwork in the immediate area of the Barranca de Cobre proper is that of Moore (*loc. cit.*) during the spring of 1934. Knobloch (Anales Inst. Biol., 21(1), 1950:155-157) did a limited amount of collecting in the upper reaches of the Barranca de Cobre in May of 1940.

The following account of species lists only material collected or observed within the boundaries of Chihuahua. Subspecific determinations are given only when supported by specimens.

Heterocnus mexicanus. Tiger Bittern. A solitary bird of this species was observed by Sheffler as it flushed from along the bank of the Urique River, 2900 feet, below our camp at the bottom of the Barranca. This observation apparently constitutes the first record of the species for Chihuahua, as Frazar, McLeod, and Knobloch failed to record it.

Anas discors. Blue-winged Teal. On May 29 a pair of teal took flight ahead of the pack train in the deep Arroyo Guachero, two miles east of Naranjo, near the Chihuahua-Sinaloa border. The same



Fig. 2. Pine forests (*Pinus chihuahuana* and *Pinus lumholtzii*) near El Cajón, Chihuahua.

pair was again encountered and collected as they flushed several hundred yards downstream. Examination of the testes and ovaries showed both birds to be in breeding condition and the female would probably have laid within a few days.

Coragyps atratus. Black Vulture. A fairly common species along the bottom and lower slopes of the Barranca. Several individuals were noted on the Urique River at 2900 feet elevation.

Cathartes aura. Turkey Vulture. Turkey Vultures were common in the bottom of the Barranca where they fed on bird carcasses from our skinning tables. One individual was observed at 8200 feet elevation in the vicinity of our camp on the west rim.

Accipiter cooperii. Cooper Hawk. A breeding male was collected at El Muerto, 5600 feet, on May 9 in the heavy pine-oak forest. The bird responded to "squeaking" at a point along the trail where it had been observed the previous evening. Neither the female nor the nest could be located, although the breeding condition of the male indicated both must be close at hand. A circling bird of this species was observed at a lower elevation, 4500 feet, on the trail below El Muerto on May 8, 1950. Frazar collected two specimens of this species at Bravo in August of 1888 (van Rossem, *op. cit.*)

Buteogallus anthracinus anthracinus. Black Hawk. Black Hawks appeared to be a rather abundant species in southwestern Chihuahua and were observed and collected at several elevations and in varying associations. An adult male was taken among the alders in the bottom of Arroyo Hondo, 5300 feet, on May 10, 1950. The bird was one of a nesting pair and an inspection of the nest revealed one egg. The crop contents of this specimen included a large centipede, an adult neuropteran insect, one lizard, and two small fish. A single bird of this species was active about camp at the rim of the Barranca at 8200 feet on May 15 and another pair was observed along the Urique River in the bottom of the Barranca, 2900 feet, on May 18. One member of this latter pair was collected by Sheffler on this date and proved to be in breeding condition.

Urubitornis solitaria. Solitary Eagle. A sharp watch was kept for trace of this large, rare hawk which had heretofore been recorded only from southeastern Sonora. A single bird was observed by Sheffler on May 12 near El Refugio, 5900 feet, in pine-oak association. A second bird of this species was sighted by Sheffler on May 16 as it circled a tall pinnacle on the west slope of the Barranca at approximately 4000 feet elevation. Neither bird was collected.

Caracara cheriway. Caracara. Caracaras were observed in the arid tropical belt of the Barranca bottom between May 17 and May 20. What appeared to be a mated pair of birds was generally in sight about our camp in the Barranca bottom.

Cyrtonyx montezumae mearnsi. Montezuma (Mearns) Quail. This species is apparently quite common in the mountains of southwestern Chihuahua, as it was encountered at several points along the trail above 5000 feet elevation. A flock of quail was observed on May 10 in the deep, white-fir-choked canyon which leads down into Arroyo Hondo. A female collected from this flock by one of the Mexican pack men proved to be too badly mutilated to save as a skin. Assignment to race is based on the distribution as given in the check-list of Mexican birds (Friedmann, Griscom, and Moore, Pac. Coast Avif. No. 29, 1950:202).

Meleagris gallopavo. Turkey. Although no specimens were obtained, turkeys appeared to be quite plentiful in the high pine-oak country west of the Barranca. The pack train was moving too rapidly to allow collection of this species, but numbers of feathers, tracks and droppings of these large birds were common along the trail. The first evidence of the presence of turkeys was encountered above Metate at 5000 feet on May 9 and the Tarahumare Indians in the area reported turkeys as abundant at Arroyo Hondo, El Refugio, Guayachi (near type locality of *onusta*), and Techumichi, which is about a two-day ride southwest of the village of Churo.

Columba fasciata fasciata. Band-tailed Pigeon. Pigeons were common at Cumbre, 8200 feet, the location of our base camp on the west rim of the Barranca. There were many nesting pairs in the area and a bird collected on May 14 contained a hard-shelled egg.

Scardafella inca. Inca Dove. Several individuals of this species were observed along the main stream course of the Urique River and in the lateral canyons emptying into the Barranca proper.

Leptotila verreauxi angelica. White-fronted Dove. A common species in the arid tropical thickets of the Barranca bottom. A breeding male was taken by Sheffler on May 18 and a female in the same condition was obtained by Stager on May 19.

Ara militaris. Military Macaw. Macaws were first encountered in Chihuahua by our field party at Arroyo Hondo, where two pair flew continually back and forth across the deep canyon, making the narrow gorge ring with their raucous cries. The species was again observed in the Barranca de Cobre below the 6000 foot level. From our camp in the bottom of the canyon it was possible to observe two or three pairs flying in and out of the cliffs at about 4000 feet where they apparently were nesting.

Aratinga holochlora. Green Paroquet. A flock of paroquets was observed at Naranjo, 3100 feet, on May 7 and May 29. The flock, consisting of approximately 100 birds, was observed in evening flight to a roost in the Arroyo Guachero, east of Naranjo. The birds passed our camp so swiftly on both occasions that it was impossible to obtain specimens.

Rhynchopsitta pachyrhyncha. Thick-billed Parrot. Thick-bills were encountered only at Cumbre, 8200 feet, on the west rim of the Barranca. Shortly after our arrival at Cumbre on May 13 a flock of approximately 35 birds passed over our camp and began feeding on the terminal buds of a stand of Chihuahua and Lumholtz pines on the nearby hillside. Several specimens were collected and of those obtained, the males outnumbered the females two to one. The remainder of the flock continued to feed in the area of Cumbre and were still present at the time of our departure on May 21.

Amazona finschi woodi. Red-fronted Parrot. Parrots of this species were first encountered at El Muerto, 5600 feet, on May 9, 1950, when several individuals flew into the pines surrounding our trail camp. An adult male in prebreeding condition was collected by Stager. From El Muerto north-eastward the species appeared to be fairly common and a second specimen was taken at Cusáraga, 6300 feet, on May 10 by Sheffler. At the end of the first day's descent into the Barranca on May 16 camp was made in a stand of oaks at the 4700 foot level on the west wall. This particular group of oaks was evidently a parrot roost of long standing; just before dark several hundred Red-fronts came streaming in from their feeding grounds and began settling into the trees for the night. An adult male was collected from this flock. Red-fronts were not uncommon in the arid tropical growth at the bottom of the Barranca at 2900 feet elevation.

Piaya cayana. Squirrel Cuckoo. A single individual of this species was observed and shot in one of the lateral arroyos of the Barranca's bottom, but it was lost as a result of its falling into a deep crevice between giant boulders. The only other recorded occurrence of this species in Chihuahua are the two specimens taken by McLeod at La Trompa in 1885.

Otus flammeolus. Flammulated Owl. An adult male and female were collected by Sheffler on May 12 at a trail camp located at Baqueré, 7000 feet, 15 miles west of Churo. The pair of birds was noticed flying from branch to branch in the large Chihuahua pine above our skinning table. The birds made no sound and a search of the pines and oaks surrounding our camp the following morning failed to disclose a nesting site. At Cumbre on the Barranca rim, on May 15, Sheffler located a nesting female sitting on eggs in an abandoned woodpecker hole. The nest hole was in a dead pine snag about twenty feet off the ground. As Sheffler beat on the base of the snag, the nesting bird thrust its head from the hole. The bird proved to be a female and the nest contained three heavily incubated eggs. A search of several other woodpecker holes in the immediate vicinity of the nest failed to disclose the male bird. This species has not previously been recorded from Chihuahua.

Otus trichopsis asperus. Spotted Screech Owl. Judging from the number of specimens collected, the Spotted Screech Owl is apparently a fairly abundant species in the oak association and the pine-oak belt of southwestern Chihuahua. Sheffler secured an adult male at Cusáraga, 6300 feet, on May 10 and I collected a male in a stand of oaks on the west slope of the Barranca at 4700 feet on May 16. The latter bird was calling and was collected by "eye-shining." Three additional males were collected near Cerocahui on May 24 in the middle of the day; each was discovered sitting in the mouth of its roosting hole in medium-sized oak trees.

Bubo virginianus pallescens. Horned Owl. These owls were frequently heard in the mountainous area of southwestern Chihuahua. At Arroyo Hondo on May 11 a pair was heard calling long after daylight. I succeeded in decoying them down the mountainside and was able to collect the male. The bird was a postbreeding adult of very small size, but within the size range of *pallescens*. Sheffler later secured a large postbreeding female at Cusáraga, 6300 feet, on May 27.

Glaucidium gnoma pinicola. Pygmy Owl. On May 21 as the pack train neared the west rim of the Barranca on the return trip, one of the men observed a small owl sitting in a large oak tree above the trail at 7200 feet elevation. The bird was collected and proved to be an adult female. The specimen agrees in size and color with examples of the race *pinicola*.

Asio stygius lambi. Stygian Owl. This owl is apparently a rare species in the northern portion of its range and it was therefore of real interest to encounter it in Chihuahua. A mated pair was collected by Sheffler at El Muerto, 5600 feet, on May 8 in a forest of oak and Chihuahua pine. The first bird was taken as it flushed from its roost in a tall pine when it was alarmed by gunshots. A search of the immediate area revealed a large nest twenty feet up in a pine. The second bird left this nest as a man began to climb the tree. This individual, the female, was collected and examination of the gonads of both specimens indicated breeding condition; the female probably would have laid in ten days or less. The nest structure was an old one made of sticks and may have originally belonged to some species of hawk. This species had previously been recorded only as far north as Sinaloa and Durango.

Caprimulgus vociferus arizonae. Whip-poor-will. Whip-poor-wills of this species were common throughout the high country of Chihuahua, as individuals were heard calling in the vicinity of almost every trail camp. Several specimens were secured, including one individual exhibiting a good deal of melanism which was taken at Baqueré, 7000 feet. All specimens taken showed evidence of breeding, and eggs were obtained by Sheffler at El Cajón, 6500 feet, and Cusáraga, 6300 feet. Both sets, taken on May 23 and May 27, respectively, were heavily incubated and deposited in shallow depressions on the ground. The species was very easily "eye-shined" and all specimens were taken in this manner.

Hylocharis leucotis borealis. White-eared Hummingbird. This was apparently a common species in the Sierra Madre. On May 28 Sheffler collected an adult female at Cusáraga, 6300 feet.

Amazilia beryllina viola. Violaceous Hummingbird. Violaceous hummingbirds were encountered in the bottom of the Barranca, 2900 feet, where Sheffler took an adult female on May 17.

Lampornis clemenciae bessophilus. Blue-throated Hummingbird. Blue-throats were found to be exceedingly abundant at Cusáraga, 6300 feet, where they frequented the willow-bordered stream in the bottom of the small valley. A number of specimens was collected at this location by Sheffler on the return trip on May 25. All were breeding except for one immature male. I took an adult male May 17 in a stand of oaks on the west slope of the Barranca at 4700 feet.

Eugenes fulgens fulgens. Rivoli Hummingbird. These large hummers were fairly common at Cusáraga, 6300 feet. One adult male was taken at this locality by Sheffler on May 27.

Trogon mexicanus clarus. Mexican Trogon. Trogons of this species are fairly common in the mountains of southwestern Chihuahua at least at elevations up to 8200 feet. One was observed among the pines at Cumbre on May 13. An adult breeding male was taken on May 22, three miles west of



Fig. 3. Conifer-covered hillsides at east end of valley of Cusáraga, Chihuahua.

Churo in the pine-oak association. Trogons were heard calling at the bottom of the Barranca, 2900 feet, but none was taken there. These latter birds may have been *Trogon elegans*, which is the dominant species in the arid tropical zone of northern Sinaloa and southeastern Sonora.

Momotus mexicanus. Mexican Motmot. Motmots probably belonging to the race *vanrossemi* were heard calling at the bottom of the Barranca, 2900 feet, on May 18.

Megasceryle alcyon. Belted Kingfisher. One was encountered along the stream at the bottom of Arroyo Hondo, 5300 feet, on May 10 and a second bird was observed flying rapidly upstream at the bottom of the Barranca, 2900 feet, on May 18.

Colaptes cafer collaris. Red-shafted Flicker. Flickers were found to be fairly abundant in suitable localities throughout the mountain region of southwestern Chihuahua. Breeding birds were collected near Churo, 7000 feet, on May 23 and at Cusáraga, 6300 feet, on May 25.

Balanosphyra formicivora formicivora. Acorn Woodpecker. Woodpeckers of this species were common at elevations above 5500 feet. Large numbers were observed at El Muerto, 5600 feet, where I took an adult male on May 9. This species was also found abundantly at Cumbre at 8200 feet on the west rim of the Barranca.

Centurus uropygialis. Gila Woodpecker. A single specimen of this species was taken at the bottom of the Barranca on May 18, but circumstances made it impossible to save the bird as a specimen. As a result the species can only be tentatively assigned to the race *fuscescens*.

Dendrocopos arizonae fraterculus. Arizona Woodpecker. These woodpeckers were observed and collected at a number of localities above the 5000-foot level. They were most frequently encountered in an oak association, but they were also common in mixed pine and oak. Specimens were taken at El Muerto, 5600 feet, Cumbre, 8200 feet, and El Refugio, 6500 feet. The birds were preparing to nest and Sheffler estimated that an adult female collected would have laid within two days.

Lepidocolaptes leucogaster umbrosus. White-striped Woodhewer. Woodhewers were encountered only at Cusáragá, 6300 feet, on May 27. On this date a breeding pair of birds was taken in heavy pine-oak association. McLeod took three specimens of this species at Carmen in 1884 and 1885.

Sayornis nigricans. Black Phoebe. A solitary phoebe was observed feeding from a rocky perch in the middle of the Urique River opposite our camp at the bottom of the Barranca.

Tyrannus tyrannus. Eastern Kingbird. Sheffler observed a pair of these birds building a nest on May 12, six miles east of Cerocahui. The nest was fifteen feet above ground in a tree of a hedgerow.

Myiodynastes luteiventris swarthi. Sulphur-bellied Flycatcher. The only flycatcher of this species encountered in Chihuahua was a breeding male taken by Sheffler at Cusáragá, 6300 feet, on May 28. Several individuals had been observed at lower elevations in northern Sinaloa, but the species tended to become fewer in numbers as the Chihuahua border was approached.

Myiarchus nuttingi inquietus. Nutting Flycatcher. A breeding male was taken by Sheffler at the bottom of the Barranca on May 18. Other individuals were seen in the same locality.

Myiarchus tuberculifer olivaceus. Olivaceous Flycatcher. A breeding female was taken by Stager on the west rim of the Barranca at 8200 feet on May 21. The bird was in the process of constructing a nest in a hollow snag six feet above the ground. The nest had not been completed and contained no eggs. Knobloch (1950, *op. cit.*) records the species at Mojarchic.

Contopus pertinax pallidiventris. Coues Flycatcher. This species was found breeding at El Cajón, six miles east of Cerocahui, on May 23, where an adult female was taken.

Empidonax difficilis immodulatus. Western Flycatcher. A small flycatcher of this species was found nesting on a rocky shelf of a small shelter cave at 7350 feet, a few miles west of Churo on May 13. The nest was of moss and was lined with rootlets and hair. The nesting site was so close to the mule trail that it was possible to ride up to it without dismounting. The first egg was present on May 13 and the bird, nest and set of three eggs were collected by Sheffler on May 22.

Mitrephanes phaeocercus tenuirostris. Tufted Flycatcher. These flycatchers were quite common in the pine-filled ravines along the west rim of the Barranca at 8200 feet and also at Cusáragá, 6300 feet. Specimens were taken at this latter locality on May 28, and many large young were noted out of the nest but still being fed by parent birds. A breeding male was taken by Sheffler near Churo, 7300 feet, on May 22.

Tachycineta thalassina. Violet-green Swallow. Swallows of this species were observed over the Urique River at the bottom of the Barranca between May 17 and May 19.

Corvus corax. Raven. Ravens were observed fairly frequently on the slopes of the Barranca as well as in the high pine-oak country lying to the west of the canyon. A nesting bird was located at Cusáragá, 6300 feet, on May 25. The nest structure was situated in the top of a tall pine. No attempt was made to reach the nest, but the bird was often observed going silently to and from the nest.

Calocitta colliei. Magpie-Jay. A single pair frequented the area about our camp at the bottom of the Barranca. Presumably the birds had a nest in the arid tropical growth on the opposite side of the Urique River from our camp, as their flights back and forth across the river were always silent with none of the raucous calls so characteristic of non-breeding birds of this species. McLeod obtained one specimen at Carmen on August 8, 1884.

Aphelocoma ultramarina wollweberi. Mexican Jay. From our observations, this large, soft-voiced jay appeared to be confined to a rather definite vegetative and altitudinal zone. All stations where the species was observed or collected were between 4700 feet and 6500 feet. Plant associations ranged from pure stands of oak to mixed pine-oak areas. The jays were abundant at El Muerto, 5600 feet, on May 8 and at Cusáragá, 6300 feet, May 10 and 25. They were absent from the west rim of the Barranca at 8200 feet, being replaced there by *Cyanocitta*, but they were again found common on the west slope of the canyon from 6200 feet on down into the oaks at 4700 feet. A nest with three heavily incubated eggs was found on the west slope of the Barranca a little above 6000 feet on May 21. A second nest was found on May 22 between Churo and Cusáragá at 6500 feet. It was placed well out on a lower limb of a Chihuahua pine twenty feet from the ground and it contained two fresh eggs. This nest was made of sticks, was lined with rootlets, and was adorned with lichens.

Cyanocitta stelleri diademata. Steller Jay. These jays were found abundantly from 6300 feet upward in heavy pine-oak and pine-fir forests. Several specimens were collected at Cumbre on the west rim of the canyon and at Cusáragá. All specimens taken showed definite indications of breeding, but no actual nesting sites were located at either of the two principal localities.

Parus sclateri eidos. Mexican Chickadee. Chickadees were not common and, although a diligent search was made for them, only two specimens were obtained in the Barranca area. An adult male was taken in the pine forest of the Barranca rim on May 21 and Shefler obtained a female near Churo, 7200 feet, on May 22.



Fig. 4. Arid tropical growth on lower slopes of Barranca de Cobre.
Pitahaya cactus in foreground.

Parus wollweberi. Bridled Titmouse. Titmice were found abundantly throughout the oak and pine-oak associations west of the Barranca. The species was abundant at Metate, El Refugio, Techumichi, Cusáraga, and west of Churo.

Psaltiriparus melanotis lloydi. Black-eared Bush-tit. Although it is probably a common species throughout similar habitat of the region, the Black-eared Bush-tit was taken only at Cusáraga where Shefler secured a breeding female on May 27.

Sitta carolinensis umbrosa. White-breasted Nuthatch. Nuthatches were found commonly at El Muerto, 5600 feet, where they were busy feeding among the pines and oaks.

Certhia familiaris albescens. Creeper. Creepers were noted commonly in the pine-oak association from El Muerto to Cusáraga.

Campylorhynchus gularis. Spotted Cactus Wren. This cactus wren was observed between El Muerto and Cusáraga (pine-oak association) and a breeding male was taken by Shefler at the latter locality on May 10. A new nest was found beside the trail below the village of Metate on May 8. All stations where we encountered this species in Chihuahua are at greater elevations than those represented in the range given by van Rossem (Occas. Pap. Mus. Zool. Louisiana State Univ. No. 21, 1945:379) in his report on the birds of Sonora.

Thryothorus sinaloa cinereus. Sinaloa Wren. Two nesting pairs of this arid tropical species were taken at the bottom of the Barranca de Cobre. The first nest was located on May 18 and contained four eggs of approximately 8 days' incubation. The purse-shaped nest was made of grass and was

draped over a limb. The tunnel entrance was heavily lined with wool. A second nest containing a set of four fresh eggs was discovered by Sheffler on May 19. A third nest, located by Sheffler on May 29 near Naranjo, contained two wren eggs and a single egg of the Red-eyed Cowbird.

Catherpes mexicanus mexicanus. Canyon Wren. One of the most frequently heard bird notes in the bottom of the Barranca was that of the Canyon Wren. The species is extremely abundant all along the canyon floor and several specimens were taken. A nest containing six fresh eggs was found by Sheffler on May 17. The nest was constructed of small twigs, grass and spider webs, with a lining of wool and fine hair.

Melanotis caerulescens effuticius. Blue Mockingbird. A breeding pair was discovered in a lateral canyon of the Barranca bottom on May 17 and the female was taken. These were the only representatives of this species observed in the arid tropical growth of the canyon. At Cusáraga, 6300 feet, in heavy pine-oak association, at least two pairs were heard singing in the dense growth of the stream bed which enters the valley from the south. A breeding male was taken at this locality on May 27.

Turdus migratorius propinquus. Robin. This species was common throughout the mountainous area of southwestern Chihuahua and was observed and heard singing at many points along the trail. On May 22 Sheffler took an incubating female with a set of three eggs near Churo at an elevation of 6500 feet. The nest was 15 feet above the ground in a small pine. Unlike most robins' nests, it contained no mud cup; instead it consisted of an outer layer of heavy grass and twigs, a middle layer of moss, and a lining of fine grass. At El Cajón, 6500 feet, a second nest was located 15 feet up in a small oak and contained three eggs considerably incubated. On the same day another nest was found near Cerocahui, 6100 feet, which contained three fresh eggs. It was in a small cedar 8 feet above ground.

Myadestes obscurus cinereus. Ashy Solitaire. The melodious notes of this solitaire were heard more frequently than the bird was actually observed. A breeding male was taken by Sheffler at Arroyo Colorado, 4000 feet, near the Sinaloa-Chihuahua line on May 8. The bird was taken in a dense thicket on an oak-covered hillside. I collected a singing male among the rocky cliffs on the gorge at El Cajón, 6500 feet, on May 23, and a third male was taken by Sheffler at Cusáraga on May 27.

Hylocichla ustulata ustulata. Swainson Thrush. Nonbreeding thrushes were abundant along the Urique River course in the bottom of the Barranca and several specimens were taken on May 17 and 18. They also were abundant along the alder-shaded stream in the bottom of Arroyo Hondo at 5300 feet.

Sialia sialis fulva. Common Bluebird. A common species among the pines and oaks at El Muerto, 5600 feet, on May 9 where a male bird was taken. It also was common about our rim camp at Cumbre.

Poliophtila nigriceps restricta. Black-crowned Gnatcatcher. A breeding male which agrees with examples of this race was taken at the Barranca bottom on May 18, 1950. Gnatcatchers were abundant in the arid tropical growth of the canyon floor and Sheffler found a nest containing four heavily incubated eggs on May 19. In this instance the nest consisted of very small twigs and plant down held together with spider webs. It was lined with down and fibres of the "kapok" tree (*Ceiba acuminata*).

Vireo solitarius pinicolus. Solitary Vireo. A common species among the pines and oaks at El Muerto, 5600 feet, where an adult male was taken on May 9.

Vireo gilvus brewsteri. Warbling Vireo. An abundant species at Cusáraga, 6300 feet, on May 26, where Sheffler took a breeding female. Warbling Vireos were observed and heard singing at several other trail localities near Cusáraga.

Vireo huttoni stephensi. Hutton Vireo. The only individual of this species collected was a breeding male taken by Sheffler at Techomichi on May 11.

Vermivora superciliosa palliata. Chestnut-chested Warbler. Warblers were common among the pines at Cumbre on the Barranca rim on May 15 and amid the arid tropical growth of the Barranca bottom on May 19. The testes of a bird taken on May 15 was somewhat enlarged, but the species appeared not to be nesting on these dates.

Peucedramus taeniatus arizonae. Olive Warbler. Sheffler took a breeding pair at Cumbre on May 21. A number of other individuals of this species were observed in the high country in the pine-oak association between Cusáraga and El Muerto.

Dendroica aestiva morcomi. Yellow Warbler. A migrating female warbler apparently assignable to this race was taken by Sheffler at the bottom of the Barranca on May 19. A number of Yellow Warblers was observed moving up canyon at the lower elevations on this date.

Dendroica graciae graciae. Grace Warbler. Warblers of this species were fairly plentiful at several localities between Cumbre and El Muerto, where Sheffler collected a breeding female on May 19.

Cardellina rubrifrons. Red-faced Warbler. Common at several trail localities between Arroyo Hondo and Cumbre. At the latter locality the species was represented by several breeding pairs in the deep, shaded, lateral canyons leading down into the Barranca.

Setophaga picta picta. Painted Redstart. Common at suitable elevations throughout southwestern Chihuahua. Birds with eggs were found near Arroyo Hondo on May 10 and at Cumbre on May 16.

Myioborus miniatus miniatus. Slate-throated Redstart. This redstart, which is rare in northern México, was only encountered at Cusáraga at 6300 feet where it was a very abundant species. The heavy tree growth which fills the ravine on the south side of the valley at Cusáraga harbored many pairs of breeding birds. Several specimens were collected and, after considerable search, two nests were



Fig. 5. Urique River course at bottom of Barranca de Cobre; Arid Tropical Zone.

located. The first nest, found on May 26, was placed in heavy grass growing on the bank of the stream approximately five feet above the water. It contained four eggs and was constructed of grass, adorned with gray leaves and one feather. The lining was of fine plant down. Pine needles had been carefully bent and draped over the nest so as to provide a side entrance. The second nest, also containing four eggs, was situated among the branches and broad leaves of a dense shrub in the bottom of the stream bed, completely hidden from view. Its presence was only detected by flushing the bird from the nest.

Basileuterus rufifrons caudatus. Rufous-capped Warbler. A solitary bird of this species was taken by me at the Barranca bottom on May 17, 1950. It was found foraging among the deciduous shrubs of the canyon bottom along the east bank of the river. The species was not encountered again.

Passer domesticus. House Sparrow. The ever-present House Sparrow was added to the avifauna of southwestern Chihuahua upon the discovery of several pairs of birds at Churo, 7900 feet, on May 13, 1950. The birds were noisily engaged in housekeeping in the tower of the old Jesuit church on the east fringe of the village.

Tangavius aneus milleri. Red-eyed Cowbird. Cowbirds were observed at only one locality in Chihuahua and that was at Naranjo, 2600 feet, on May 7 and May 29. It was close to this locality that Sheffer also found the nest of *Thryothorus* that was parasitized by this cowbird.

Icterus wagleri castaneopectus. Wagler Oriole. Although a very common species in the Arid Tropical Zone of Sonora to the westward, the Wagler Oriole was encountered only once in southwestern Chihuahua. On May 16 Sheffler collected an adult female among the oaks half way down the west slope of the Barranca at the 4700 foot level. The species was not detected among the arid tropical growth of the canyon bottom.

Piranga flava hepatica. Hepatic Tanager. Tanagers of this species were common among the pines and oaks at El Muerto, 5600 feet, on May 9 when two adult birds, male and female, were collected.

Piranga ludoviciana. Western Tanager. A number of migrating Western Tanagers was noted in the arid tropical growth of the Barranca bottom between May 17 and May 19. The birds all appeared to be moving northward and no individuals remained in the immediate area of our river camp for long.

Richmondia cardinalis affinis. Cardinal. Cardinals were noted in the arid tropical growth of the Barranca bottom and an adult male assignable to this race was taken on May 17. On May 18 Sheffler took a nest and set of three heavily incubated eggs in the same area.

Pheucticus melanocephalus melanocephalus. Black-headed Grosbeak. Encountered at Cusáraga only, where Sheffler succeeded in collecting a breeding male on May 26. Comparison of this individual with series of *melanocephalus* and *maculatus* indicates that it is referable to the former race.

Passerina versicolor dickeyae. Varied Bunting. Buntings assignable to this race were noted as fairly abundant in the Barranca bottom between May 17 and May 20. An adult male was taken at this station on May 19.

Carpodacus mexicanus. House Finch. House Finches were fairly common about the camp area in the bottom of the Barranca between May 17 and 19. Sheffler found birds with fresh eggs at El Cajón (east of Cerocahui) on May 12 and close to Cerocahui, 6100 feet, on May 23.

Loxia curvirostra stricklandi. Red Crossbill. A small flock of crossbills was active among the pines about our rim camp at Cumbre at 8200 feet. Sheffler succeeded in collecting a juvenal male and an adult female on May 21.

Chlorura chlorura. Green-tailed Towhee. A solitary migrant towhee was taken on the hillside above the Barranca bottom on May 18, 1950. No other individuals of this species were observed.

Pipilo erythrophthalmus griseipygius. Red-eyed Towhee. Towhees were found commonly at Cusáraga on May 10 and again between May 25 and 27. All specimens taken were breeding birds, but no nests were found. Sheffler found a nest and three fresh eggs east of El Cajón, 6500 feet, on May 22. The nest was situated in a small shrub two feet off the ground and was constructed of coarse grass with a lining of fine grasses. A second nest containing two fresh eggs was found at Cerocahui on May 23, and it too was placed in a small bush two feet above the ground.

Pipilo fuscus perpallidus. Brown Towhee. These towhees were observed frequently in suitable localities at elevations between 5500 and 7000 feet. The stone fences enclosing the small ranches of the Tarahumare Indians were a favorite shelter for these birds. On May 22 near Churo, 6500 feet, Sheffler found a nest and three fresh eggs. The nest was in a small bush and was constructed of weed stalks. The lining was of fine grass and included some hair.

Atlapetes pileatus dilutus. Rufous-capped Atlapetes. This shy sparrow was encountered only at Cusáraga at 6300 feet, where I took an adult breeding male on May 10. All individuals observed were in heavy cover which choked the mouth of the wooded canyon leading into the valley from the south. A few individuals were seen again at the same location between May 25 and 27.

Aimophila ruficeps simulans. Rufous-crowned Sparrow. These sparrows were common throughout the higher elevations and in much the same type of habitat as that selected by *Pipilo fuscus*. I collected breeding birds at Guasagota, 6250 feet, on May 10 and at El Cajón, 6350 feet, on May 23.

Junco phaeonotus palliatus. Mexican Junco. Juncos were found only at Cumbre at 8200 feet on the west rim of the Barranca. In this area they were common, and specimens collected on May 15 showed evidence of nesting.

Spizella passerina atramaeus. Chipping Sparrow. A solitary incubating female and four fresh eggs of this species were taken by Sheffler six miles east of Cerocahui on May 12. The nest was placed among the branches of a small pine. This specimen is assignable to the race *atramaeus* after comparison with a series from nearby localities in the Robert T. Moore Collection.

Los Angeles County Museum, Los Angeles, California, April 21, 1953.

EXPERIMENTS ON SOCIAL BEHAVIOR IN NONBREEDING BREWER BLACKBIRDS

By THOMAS R. HOWELL and GEORGE A. BARTHOLOMEW, JR.

In a previous paper (Howell and Bartholomew, *Condor*, 54, 1952:140-151), we described a series of experiments on mating behavior in the Brewer Blackbird (*Euphagus cyanocephalus*) in which the responses of the birds to stuffed specimens (dummies) were studied during the breeding season. The present study is concerned with similar experiments on behavior during the nonbreeding season.

As in our previous work, the experiments were performed on the campus of the University of California, Los Angeles. We prepared dummies in approximately lifelike form and placed them in locations where they would be noticed by the blackbirds, sometimes scattering crumbs to attract attention. Dummies of the Brown Towhee (*Pipilo fuscus*), the California Thrasher (*Toxostoma redivivum*), the female Red-winged Blackbird (*Agelaius phoeniceus*), and both the male and the female Brewer Blackbird were used. Experiments were carried on from October 21, 1951, to March 23, 1952, and from July 26, 1952, to November 23, 1952.

All dummies were arranged approximately in the precoital posture of the female Brewer Blackbird, a position which elicits vigorous responses from males of that species during the breeding season. By using dummies of both sexes of the Brewer Blackbird, we tested for seasonal changes in the mating and aggressive responses. By using dummies of other species of somewhat similar size and color, we tested for seasonal changes in the specificity of responses.

In addition to the reactions described in our earlier paper, which follows the terminology of Williams (*Condor*, 54, 1952:3-47), we observed two other types of response:

Mounting by the male.—Males frequently mounted the dummy and stood or crouched on its back without attempting copulation. This response contrasts with "incomplete copulation," in which copulation apparently is attempted but semen is not deposited.

Gathering by both sexes.—This is a group response in which virtually all the blackbirds within sight of a dummy assemble around it in a dense flock (fig. 1). This response is also present in the breeding season, but is more fully developed in the fall and winter, when the birds spend most of their time in large flocks.

RESULTS

The responses of Brewer Blackbirds to the various dummies are described below. Documentation is supplied by citations from our field notes of typical incidents.

Male Brewer Blackbird Dummy.—A male dummy with yellow eyes, which had evoked avoidance and intimidation responses in the spring of 1951, was tested in the fall of 1951 and the winter of 1952. It evoked only slight avoidance with no sign of aggression.

October 28, 1951.—The dummy was placed 30 feet from a flock of blackbirds and crumbs were scattered. Females came up immediately, but they approached no closer than about four feet. Males were more wary and stayed 12 to 18 inches farther away.

February 6, 1952.—The dummy was placed about 40 feet from a flock of blackbirds, and crumbs were scattered. During the next ten minutes three females and two males approached the dummy, looked at it alertly, but did nothing else.

Female Brewer Blackbird Dummy.—Responses to this dummy from fall until late winter were not uniform, but they followed a general pattern. The gathering response was strong, with as many as 100 birds assembling within a radius of 15 feet. Females



Fig. 1. Brewer Blackbirds gathering in response to a female dummy of their own species. The arrow indicates the position of the dummy; note the male hovering above and behind it.

were usually the first to approach the dummy, and they often pecked it aggressively. During the gathering response, males sometimes formed the innermost ring of the assemblage. The males directed no displays of any kind at the dummy, and there were no vocalizations. Some apparently strong copulatory attempts were made, but more often the males mounted and made either a weak attempt or none at all. Usually they pecked at the dummy's head. No semen was deposited at any time.

November 24, 1951.—A female dummy was placed on the ground near a flock of blackbirds. Immediately a male which had been standing about eight feet away walked to the right rear of the dummy, mounted it without displaying, crouched slightly, and pecked at its beak. He dismounted and then repeated the performance twice more. The dummy was placed in a new location, within 10 feet of several males. One came up at once, mounted for an instant, and was immediately displaced by another male. A few *keck* notes were uttered, and a flock of about 50 birds gathered—some alighting, some hovering—about the dummy within a radius of 12 feet. A passing automobile alarmed the flock slightly, and most of the birds rose into the air. We picked up the dummy and moved it to a point about 15 feet away; the birds actually followed and immediately gathered in a dense flock about it again. There were now 75 to 100 birds within a radius of 15 feet of the dummy. Those birds within 24 inches of it were mostly males. One of them mounted and seemed to attempt copulation, but he was displaced in a moment by another male. The second male made a less vigorous attempt, ceased after a moment, and remained standing on the dummy, pecking at the base of its bill. After about a minute he dismounted and another male mounted; the latter did not attempt to copulate, but pecked at the head of the dummy.

October 21, 1951.—A dummy was set out and crumbs were scattered. Six males and four females approached and one of the latter gave the dummy several hard pecks in the cloacal region. One male made five abortive mountings, hopping on the rump of the dummy and immediately hopping off. The dummy was moved to another location. Five females came up at once, and again one gave it several hard pecks in the cloacal region.

A female dummy provides a great attraction for Brewer Blackbirds during the non-breeding period and often evokes the mounting response of the male, but the lack of precoital displays and completed copulation is in strong contrast to the responses of the males during the breeding season.

In February and March, however, responses were intermediate between the general

type just described and the strong mating responses observed later in the spring. Blackbirds may give ruff-out displays at any time of year, but the earliest time that such a display was directed toward a dummy was the first of February.

February 1, 1952.—After most of the members of a flock of blackbirds which had been gathered around a dummy for about seven minutes had departed, a male approached the dummy from the right front and gave a weak ruff-out display with vocalization. The display was asymmetrical in that only the right wing was extended. This male mounted, performed a weak and incomplete copulation, and dismounted. He then mounted again without displaying and pecked gently at the bill of the dummy. He dismounted, and for two minutes walked back and forth in front of the dummy giving half ruff-out displays and vocalizing; sometimes he faced the dummy, sometimes he had his back to it. Then he left without approaching the dummy again.

In the latter part of March both positive and negative responses to the dummy were obtained.

March 23, 1952.—The dummy was set out and crumbs were scattered. A male approached to within three feet of the dummy and paced back and forth, giving ruff-out displays and vocalizing. He seemed wary, however, and came no closer. The dummy was moved to within 25 feet of another male, but he only watched it quietly and did not approach. Again the dummy was moved and placed near some other blackbirds. One male walked directly but not rapidly to within 12 inches of the dummy, circled around it, hopped back, and then advanced and mounted without displaying. He did not attempt to copulate but remained standing on the back of the dummy for about 90 seconds, and he gave a clear whistled note several times.

The dummy was again moved to a new location. A male flew up from more than 30 feet away, alighted, walked rapidly to the dummy, and mounted without display. He performed a vigorous but incomplete copulation. A second male flew up and attempted to dislodge the first, and a flock of about 20 birds gathered about the dummy. One of the males mounted, performed several incomplete copulations, dismounted, and began giving both precoital and elevated-tail displays. A third male approached and then retreated as the male by the dummy gave a head-up intimidation display. No other birds approached or mounted the dummy.

Brown Towhee Dummy.—The posture of this dummy was similar to that of the female blackbird dummy, but its head was horizontal instead of pointing slightly up-



Fig. 2. Brewer Blackbirds gathered about a dummy of a Brown Towhee which has been blown over by the wind. The flock is about to depart.

ward. We tested it in the winter of 1951-52 and obtained both negative and moderately positive responses. The Brown Towhee dummy provided some attraction for the blackbirds, but it was decidedly less attractive than a dummy of their own species.

February 5, 1952.—The towhee dummy was placed near a group of about 50 blackbirds and crumbs were scattered near it. Birds of both sexes came up to pick at the food; some came as close as 18 inches to the dummy, but they seemed only slightly curious and a little wary.

December 9, 1951.—The towhee dummy was placed near a flock of foraging blackbirds, and crumbs were scattered. The flock moved toward the dummy from the rear. One male in the lead approached the dummy rapidly from a distance of about 10 feet, but when within 12 inches of it he hopped into the air, hovered about 24 inches above it, and gave several harsh scolding notes. Two or three other males then approached from behind and stood 12 to 15 inches from the dummy, looking at it alertly but not touching it. The flock then gathered loosely behind the dummy but did not form the usual tight circle around it (fig. 2).

California Thrasher Dummy.—The posture of the thrasher dummy was similar to that of the dummy of the female Brewer Blackbird, but the head pointed slightly downward. It was tested in February, 1952, at which time the blackbirds were occasionally directing displays to a female dummy of their own species. Like the Brown Towhee dummy, the thrasher dummy elicited a moderately positive response.

February 6, 1952.—The thrasher dummy was placed within 15 feet of a flock of 8 or 10 blackbirds, and crumbs were scattered. A female walking by about 12 feet away gave a sharp *tschup* note and about six birds gathered loosely about the dummy. Females approached to within three feet and three times took wing and hovered just above the dummy. Males approached less closely but also watched the dummy alertly. After about 10 minutes the group dispersed.

Red-winged Blackbird Dummy.—The posture of the female Red-winged Blackbird dummy was exactly the same as that of the female Brewer Blackbird dummy. Each time it was tested in the fall and winter of 1952 it was a source of interest and attraction to the blackbirds. It elicited a well marked gathering response, but it evoked none of the reactions associated exclusively or primarily with reproductive activity.

October 9, 1952.—A female Red-winged Blackbird dummy was placed on a lawn between two small flocks of blackbirds, about 25 feet from each group. After a minute or two a male from one flock flew toward the other flock, his course carrying him directly over the dummy at a height of about three feet. When directly above the dummy, he stopped abruptly as if he had hit an invisible barrier and fluttered to the ground about 18 inches behind the dummy. He then walked to within six or eight inches of it but stopped and did not come closer. After 45 seconds he faced away from the dummy, suddenly took wing, and hovered two feet above it. No sound was uttered, but all the blackbirds in both flocks immediately ceased foraging and gathered about the dummy, females in the lead. The birds remained assembled about the dummy for two and a half minutes and then simultaneously flew away. None had touched the dummy.

DISCUSSION

One reaction, the gathering response, was obtained with all the dummies tested. A similar group response occurs with dummies of the female Brewer Blackbird during the breeding season, but there are consistent differences. The chattering, bobbing, and displaying which are characteristic of a flock gathered around a mating "pair" in the breeding season are absent in fall and winter. Instead, there is less rapid and less frequent vocalization, or none at all; there is no bobbing, no displaying, and often the females attack the dummy. No group response to dummies of other species was obtained during the breeding season in 1951, but during the nonbreeding season the gathering response was obtained in greater or lesser degree with various species which were somewhat similar in appearance to the female Brewer Blackbird. It is noteworthy, however, that the male blackbirds never attempted to mount the dummies of these similar species and that none of these species was attacked by the female blackbirds.

Brewer Blackbirds will often gather around one or several individuals of their own species which have discovered food, but in such situations food seems to be the only interest. The gathering response to a dummy, however, often occurred when no food had been scattered, and often no attempt was made to forage in the vicinity of the dummy even if crumbs were present. It is unlikely, then, that food was ever responsible for more than the initiation of the gathering response. The gathering response seems to be more

pronounced in the fall and winter, but these are times when the blackbirds normally form large flocks, and it may be that the strong gathering reaction during the nonbreeding season is related to the pronounced flocking tendency apparent at this time. The significance, if any, of the gathering response is not clear. Possibly the response is an experimental artifact, but it does throw some light on the nature of blackbird behavior.

The significance of the aggressiveness shown to female dummies of their own species by the female Brewer Blackbirds during the nonbreeding season is likewise not clear. Nor is it clear why their attacks should be directed at the crissum; aggressive pecking by passerines is usually aimed at the head, especially the eyes.

The contrast between the response of the male Brewer Blackbird to a female dummy of that species in the breeding and nonbreeding season is of interest. In the breeding season the dummy almost always evokes a precoital display followed by mounting and a vigorous attempt at copulation. Frequently semen is deposited on the dummy. In the nonbreeding season, when the males are physiologically incapable of insemination, mounting and sometimes the motions of an attempt to copulate may still occur. Often the copulation "attempt" is weak, and sometimes the male does no more than step onto the back of the dummy and stand there, performing no other action that suggests a reproductive response.

These observations indicate that some activities which are involved in the response to the female Brewer Blackbird dummy during the breeding season may be elicited at any time of year whereas others are confined to the breeding season. It appears that mounting of a female dummy by the male Brewer Blackbird is a year-round response and that it is species-specific at all seasons. Precoital and intimidation displays with regard to a dummy seem to be forthcoming only during the breeding season or near its onset, but the gathering response is present throughout the year.

The data suggest that the mating performance of the male Brewer Blackbird depends only in part on a high level of testicular hormones, although this condition is obviously necessary for completed copulation. Definite evidence that precoital and intimidation display depend on testicular hormones, however, requires more extensive experimentation and a technique, at present unavailable, for directly determining the level of androgens in the blood of individual birds.

SUMMARY

The responses of Brewer Blackbirds in the nonbreeding season to dummies of their own species and other species of somewhat similar appearance were tested and compared with responses in the breeding season. Male Brewer Blackbird dummies evoked only avoidance or indifference from both sexes. Female Brewer Blackbird dummies evoked a variety of responses, including aggression by females, mounting with or without copulation attempts by males, and gathering about the dummy by both sexes. Dummies of other species (*Pipilo fuscus*, *Toxostoma redivivum*, and female *Agelaius phoeniceus*) evoked the gathering response but nothing more.

No displays were directed toward any of the dummies during fall and winter. Gathering by both sexes and mounting by the male seem to be year-round responses, while pre-coital and intimidation display are confined to periods of marked gonadal activity and are probably stimulated by testicular hormones. Completed copulations occur only in the breeding season.

Department of Zoology, University of California, Los Angeles, California, April 8, 1953.

INTERSPECIFIC RELATIONS OF BREEDING GULLS AT HONEY LAKE, CALIFORNIA

By DAVID W. JOHNSTON and M. E. FOSTER

In the spring of 1940, J. S. Dow reported the first positively known nesting colony of the Ring-billed Gull (*Larus delawarensis*) in California (Moffitt, 1942:105). On May 3 he and James Moffitt visited the colony which was located on a small island in the freshwater Hartson Reservoir at Honey Lake, Lassen County. The colony contained approximately 150 nests, but no completed sets were present on this date. Local residents claimed that gulls, presumably of this species, had bred on this reservoir since the middle 1920's even though Honey Lake itself had been intermittently dry.

The following year on May 14, Moffitt again visited the colony and found the gulls nesting on three separate islands in the reservoir. There were about 75 nests on one island, and he estimated that 250 pairs were nesting on the three islands. Most of the sets on this date were believed to be complete and they contained three eggs on the average. Incubation ranged from just begun to one-fourth completed. Some of the fresh eggs were placed in an incubator, and the incubation period was determined to be 26 to 27 days.

At no time during these years did anyone report the presence of the California Gull (*Larus californicus*) at this colony although this species has long bred 28 miles to the northwest at Eagle Lake, Lassen County, and 45 miles east-southeast at Pyramid Lake, Washoe County, Nevada.

ADDITIONAL OBSERVATIONS

Foster arrived at Honey Lake as refuge manager in 1949 and first noted breeding gulls in 1950. At this time approximately 750 nests were counted on a small duck pond near the refuge headquarters, and, as far as is known, gulls did not nest on the islands in Hartson Reservoir that year. This was probably due to the fact that there was very little water in the reservoir in the early spring—probably not enough for any of the hummocks to be surrounded and form islands. When the nests were counted, it was thought that *L. californicus* was also breeding, partly because of adults observed and partly because of differences in egg sizes. Since 1950, gulls have again utilized the small islands in the reservoir, which has remained full of water.

On July 18 and August 9 and 10, 1952, Johnston visited the Honey Lake Valley. It was too late to observe breeding birds, but numerous *L. delawarensis* (both adults and birds-of-the-year) were noted on various fields, small lakes and streams. An occasional adult *californicus* was seen in these flocks, indicating that perhaps this species also bred in the area.

On May 17, 1953, Johnston and R. D. Taber visited Hartson Reservoir and observed flying gulls of both species. About one-fourth mile offshore on a small flat island a large group of gulls was seen. En route to the island we stopped at two grassy islands where, according to Foster, gulls had nested in previous years, but this year gulls did not occupy them. One was entirely vacant and the other contained about 40 Forster Terns (*Sterna forsteri*) which showed a decided interest in our presence by diving at us. As we neared the island with gulls, more and more gulls flew around us calling excitedly, and we saw a large number standing and sitting in the short grass. The majority of these were adult *delawarensis*, but we also noted a few adult and fewer subadult *californicus*.

Immediately on our landing, we began to find gull nests. Birds would rise from the short grass in front of us but would return immediately to the nests after we passed. By closely scrutinizing the standing, sitting, and flying gulls, we roughly estimated 10

delawarensis for every *californicus*. Since estimating numbers of moving gulls is exceedingly difficult, especially when more than one species is involved, we decided to make a census of all nests in the colony. Gulls did not nest all over the island but occupied approximately four-fifths (30×200 yards) of it. There was a tendency to nest in the grass, not on the mud, and toward a low ridge which contained a growth of rabbit brush (*Chrysothamnus* sp.) and five-hook bassia (*Bassia hyssopifolia*) two to four feet in height.

Many of the nests were within three feet of each other, but the average distance between nests was probably more than four feet. All the nests of *californicus* were located on the low ridge, being surrounded by and intermixed with nests of *delawarensis*. Since these two species of gulls have eggs which are similar in color and shape, it was necessary to identify nests by relative size of eggs, the eggs of *californicus* being consistently larger. Nests for the most part were completely unprotected from the sun, but a few were located so that the larger plants afforded some shade. Censusing of the entire colony required about one hour and consisted of tabulating nests and contents by crisscrossing through the colony. Only occasionally did we find what appeared to be uncompleted nests, and these could conceivably have belonged to either species although more likely to *californicus*. The result of the nesting census is presented in table 1.

Table 1

Census of Gull Nests on an Island in Hartson Reservoir, Honey Lake, on May 17, 1953

Nest contents	Number of nests	
	<i>Larus delawarensis</i>	<i>Larus californicus</i>
1 egg	29	2
2 eggs	129	17
3 eggs	490	7
4 eggs	20	
5 eggs	17	
6 eggs	8	
2 eggs, 1 young	10	
1 egg, 2 young	6	
1 egg, 1 young	6	
2 young	2	
Totals	717	26

From the presence of nestlings a day or two old and the presence of pipping eggs in nests of *delawarensis*, we began to suspect that the eggs of this species were further advanced than were the eggs of *californicus*. In order to test this supposition, more than a dozen eggs of both species from random nests were broken open, with the result that all the eggs of *delawarensis* were found to have been incubated two or more weeks whereas the eggs belonging to *californicus* were found to be either fresh or incubated up to an estimated four days' maximum.

From table 1 it is readily apparent that the median number of eggs in the clutches of *delawarensis* was about three. The significance of clutches with only one egg is not fully understood, but it is probable that these sets were complete since developing embryos were contained in the few that were broken. (A completed clutch of only one egg was found to be not infrequent in nests of *californicus* at Mono Lake, California, by Johnston.) Possibly some of the single eggs were infertile or had been deserted. No individuals of *delawarensis* were collected to ascertain internal conditions of reproductive physiology.

The small number of nests of *californicus* posed further problems. At such an early

stage of incubation, it would seem as though *californicus* was not yet through laying, and such might have been true for some individuals in the colony. All the available evidence, however, indicates that they had just finished laying. In the first place, two adult females collected both exhibited well developed incubation patches and ovulated follicles. Neither showed any follicles ready to be ovulated or eggs anywhere in the oviduct. In the second place, other observations at other colonies (Pyramid Lake, Marshall and Giles, 1953:113; Mono Lake, Johnston, MS) indicate that the mean number of eggs for this species is about two.

From the number of nests counted it becomes apparent that there were more than 1400 *delawarensis* and at least 55 *californicus* (including three subadults) present at this colony.

DISCUSSION

Comparison of dates of nesting in different years.—It will be recalled that Dow and Moffitt found only incomplete sets of *delawarensis* on May 3, 1940. Assuming that full clutches were attained within the next two or three days, by adding 26 or 27 days (the incubation period as determined by Moffitt), one might suppose that the eggs would have hatched at least by June 1 of that year, and perhaps earlier. In 1953, although some hatching had already commenced by May 17, many of the eggs which we broke open were only about one-half incubated. Thus, these, too, would have hatched out by June 1. These interpretations of the existing data would indicate a similarity in the time of nesting in these two years at this colony, although there is some indication that the nesting in 1953 was slightly more advanced than in 1940.

Increase in Ring-billed Gulls.—By examination of total counts and estimates made of the nesting gulls in this colony for several years, it is definite that *delawarensis* has increased in numbers at least since 1940. Counts and estimates of breeding pairs are as follows: 1940, 150±; 1941, 250±; 1950, 700±; 1953, 717.

Colonization of California Gulls.—Just exactly when *californicus* first nested in Honey Lake Valley is not known, but from the data at hand it was probably between 1941 and 1950. It would seem that one condition to be fulfilled in order for numbers of these gulls to occupy new breeding grounds would be that of considerable population pressure in the closer, established colonies. One might speculate that the "invading" birds came from either Eagle Lake or Pyramid Lake, the closest breeding colonies. Another possible source would be migrants which did not reach other colonies to the north (for example, Tule Lake and Klamath Lake). Since the Eagle Lake population has always been small—something on the order of four pairs (see Grinnell, Dixon, and Linsdale, 1930:226-227)—and since the Pyramid Lake population has been increasing into the thousands according to Marshall and Giles (1953:115), it is more probable that *californicus* came from Pyramid Lake. Sooner or later it might be possible to prove this point, for rather extensive banding has been undertaken at Pyramid Lake, and, if any birds did move over to Honey Lake, they would be detectable by the presence of bands. Such an instance would be of considerable interest because there seems to be a general tendency for *californicus* to return to its natal grounds for breeding (see, for example, Woodbury, Behle, and Sugden, 1946:13).

Competition and ecologic separation.—As far as food habits are concerned, there is no evidence that the two species differ to any great extent, although we have not examined any large number of stomachs critically. From observations of wintering gulls in the San Francisco Bay area, it is known that *delawarensis* and *californicus* fare better together than do either or both of them with their larger congeners. In this connection it should be indicated that *californicus* is only slightly larger than *delawarensis*. The two species frequently feed together in wintering flocks, and also in the Honey Lake Valley

in the open fields and along water courses. They are to be found together in migrating flocks. So it seems that the two species occupy similar food niches; at least their niches are as close as has been observed in the various species of gulls.

In the wintering flocks of gulls in the San Francisco Bay area, where one finds large numbers of the Herring Gull (*Larus argentatus*), there will almost always be considerable numbers of the Glaucous-winged Gull (*L. glaucescens*) and perhaps the Western Gull (*L. occidentalis*). Large flocks of wintering gulls at garbage dumps are essentially devoid of the smaller *californicus* and *delawarensis* due to their inability to compete with the larger species. These two situations indicate a correlation between size of the bird and food niche.

There are several localities in North America where *californicus* and *delawarensis* have been known to nest on the same lake for years. In these instances, the two species may either occupy the same or different breeding sites. Gabrielson and Jewett (1940: 292) state that the two species nest in separate and distinct areas, with *californicus* usually entirely surrounding *delawarensis*. At Malheur Lake, Oregon, Willett (1919: 196) reported that the nests of the two species did not overlap, and in this instance there were 500 pairs of *delawarensis* and 60 pairs of *californicus*. Bent (1947:126) records nesting of the two species in Saskatchewan on the same island where apparently their numbers were equal: "The nests of the ring-billed gulls were chiefly on the higher portions of the island, while those of the California gulls were mostly around the shores and on a bare, flat point, though both species were somewhat intermingled when the two colonies came together." At Honey Lake there was only a slight tendency toward spatial segregation, and this was not entirely conclusive. Probably the proximity and intermingling of nests at this colony were due to the small size of the island on which the gulls nested.

The most interesting single fact resulting from our study was the ecologic separation of the two species in reference to the timing of their nesting cycles. It will be recalled that all the nests of *delawarensis* contained eggs at least one-half incubated whereas the eggs of *californicus* were relatively fresh. This would mean, of course, a difference in time when the young of the two species would hatch and therefore would tend to stagger the greater demands on the available food supply. As a possible exception to a phenological difference in these two species is the situation reported by Willett (*loc. cit.*) in which *californicus* began to lay on June 7 whereas *delawarensis* began on June 5. These dates, however, seem to be exceedingly late for both species to begin laying in Oregon, and one might suspect that there was a tendency toward overlap of nesting due to a late season locally.

In conjunction with our findings, the reader is referred to a comprehensive investigation of the breeding biology of two sympatric colonial species of European gulls. Paludan (1951:table 6, 40; 46) found that *L. argentatus* occupied the colony before *L. fuscus*, attributing this phenomenon to the fact that *fuscus* migrates much farther to the south. Furthermore *argentatus* reaches the height of its egg-laying period during the last third of April but *fuscus* not until the middle of May. Here, then, is another example of closely related sympatric species being somewhat ecologically separated by a difference in breeding times.

In addition to the phenological difference pointed out and the obvious morphological difference between *californicus* and *delawarensis*, there are probably also differences in voice, flight, reproductive physiology, and behavior patterns which we have not observed.

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NOTES ON AUTUMNAL TRANS-GULF MIGRATION OF BIRDS

By J. B. SIEBENALER

Autumnal records of migrant land birds over the Gulf of Mexico have been reviewed by Lowery (Auk, 63, 1946:191-195) and more recently by Lowery and Newman (in press). Since there are actually far more records of land birds over the Gulf in spring than in fall, the following autumnal observations made aboard the Fish and Wildlife Service exploratory fishing vessel, the "M/V Oregon," may be of interest to students of bird migration. In the text that follows the figures in brackets refer to the positions of the "Oregon" indicated on the map, figure 1.

On the afternoon of September 17, 1952, the "Oregon" was working at latitude 29° 00' N., longitude 87° 55' W. [1], approximately 73 miles off the Alabama coast and 49 miles east by south of North Pass, Louisiana, the nearest land. At about 3:10 p.m., a flight of twenty-two Common Nighthawks (*Chordeiles minor*) was observed heading south. The flight came near the vessel and one was shot for positive identification. The flight approached from astern and did not change course in passing the vessel. The nighthawks were flying from 20 to 30 feet above the water and drew abreast of the "Oregon" at a distance of 10 to 20 yards. Their air speed was not great and can be estimated at less than 30 miles per hour. The "Oregon" was traveling at 10 knots in the same direction as the birds and was quartering a southeast wind of 6 to 8 miles per hour. The flock did not change its course while under observation and disappeared in the south. The sky was partly cloudy but the visibility was good and the weather had been good on the preceding day.

The same weather conditions prevailed about three hours later, 6:20 p.m., and about 27 nautical miles farther south at latitude 28° 33', longitude 87° 55' [2], when six nighthawks passed the "Oregon," also headed south and flying at about the same height above the water.

On the morning of September 18, the "Oregon" was at latitude 29° 12', longitude 87° 49' [3], about 63 miles south of Mobile Bay, Alabama. A single duck was sighted heading north. At 9:40 a.m., some 16 miles west of the previous position one swallow was observed moving toward the north. Shortly after 4:00 p.m. while at latitude 29° 12', longitude 88° 05' [4], one immature Magnolia Warbler (*Dendroica magnolia*) stopped on the vessel. Four other warblers went by headed north by northeast. The wind was from the southeast at a rate of 6 to 8 miles per hour. It was raining and sky was overcast.

Early that evening while traveling on a true course of 268 degrees to the anchorage position at latitude 29° 15', longitude 88° 18' [5], about 30 miles east of North Pass, Louisiana, birds were heard overhead. About 35 to 40 small birds came over the stern. They hovered there for a few seconds and then flew in random directions. It was raining, the skies were overcast, and visibility was very poor. Birds were in sight continuously for the 25-minute run to the anchorage position. The observations made that evening while on anchor have been extracted from the bird log and are presented here:

7:05 p.m. Raining, visibility poor. The wind from the south decreasing in velocity from 12 to 6-8 m.p.h. About 30 to 40 warblers and other small birds seen at any one time about the vessel. A Least Flycatcher (*Empidonax minimus*) and a Phoebe (*Sayornis phoebe*) taken.

7:10 p.m. A Least Bittern (*Ixobrychus exilis*) landed on the outrigger stays. Easily captured by hand.

7:30 p.m. About 50 warblers and other small land birds seen about the vessel. Some landed for a few seconds on the deck, rails and riggings. Three Black-burnian Warblers (*Dendroica fusca*) and

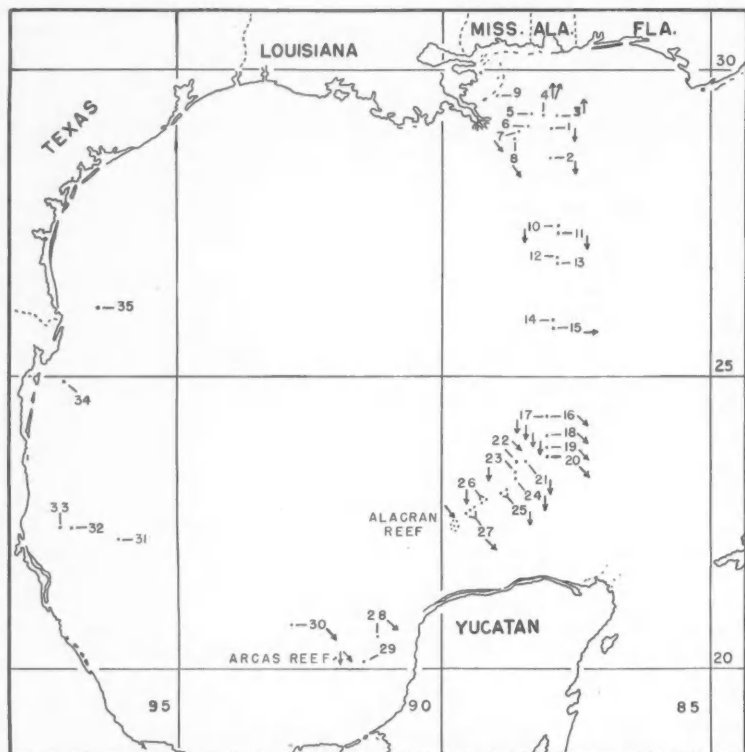


Fig. 1. Positions of the "M/V Oregon" in the Gulf of México in September and October of 1952. Arrows indicate directions of flight of birds observed.

two Red-eyed Vireos (*Vireo olivaceus*) and three Magnolia Warblers were collected. Raining with occasional gusts of wind from the southeast up to 20 m.p.h.

8:30 p.m. Rain began to let up, 30 to 40 birds about the boat but not attempting to land.

10:30 p.m. Skies cleared, rain ceased. Very few birds about.

11:00 p.m. No birds seen.

On the afternoon of September 19 at latitude $29^{\circ} 01'$, longitude $88^{\circ} 24'$ [6], thirty miles off the delta of the Mississippi River, several birds were seen flying about the boat. A Black and White (?) Warbler (*Mniotilta varia*) stopped on deck and flew away when approached. A Bobolink (*Dolichonyx oryzivorus*) was captured at this time by cast net.

At 9:17 a.m. on September 20, while at latitude $28^{\circ} 58'$, longitude $88^{\circ} 33'$ [7], 28 miles southeast of South East Pass, Louisiana, 36 small ducks were seen heading south-east. They were flying close to the water at a speed in excess of 30 miles per hour. The wind was from the southeast at 2 to 4 miles per hour. Two hours later while at latitude $28^{\circ} 49'$, longitude $88^{\circ} 37'$ [8], about 30 miles southeast of South Pass, Louisiana, 2 small, unidentified sandpipers were observed heading south by southeast.

The "Oregon" was anchored at latitude 29° 37', longitude 88° 55' [9], 5 miles south of the southern tip of Chandeleur Island, Mississippi, on the night of September 20. The sky was overcast and the wind was from the east by southeast at 15 miles per hour. No birds were heard or seen until 11:40 p.m. when birds were observed flying about the vessel. A Prothonotary Warbler (*Protonotaria citrea*) hit the rigging and fell on deck. The steady peeping of birds could be heard for twenty minutes. Later during the same night birds were heard overhead for twenty-five minutes.

Table 1

Bird Observations from October 1 to 4, 1952, Made Aboard the "M/V Oregon"

Date in October	Time	Position of "Oregon" Lat. North Long. West	Position in fig. 1	Species	Number	Direction of flight
2	6:05 a.m.	27° 30' 87° 50'	[10]	warblers	3 flights (2-4 each)	south
2	6:50 a.m.	27° 24' 87° 50'	[11]	ducks (Red-heads?)	30	south
2	10:20	26° 50' 87° 55'	[12]	sparrow	1	undetermined
2	10:40	26° 46' 87° 57'	[13]	Barn Swallow	1	undetermined
2	4:22 p.m.	25° 50' 87° 57'	[14]	Mourning Dove	1	undetermined
2	4:50	25° 45' 87° 57'	[15]	swallows	6	east
3	10:55 a.m.	24° 16' 88° 00'	[16]	ducks	65-75	southeast
3	10:59	24° 16' 88° 00'	[17]	warblers and other land birds	thousands	south
3	11:17	24° 13' 88° 00'		nighthawks	1	south
3	11:35	24° 10' 88° 00'		Barn Swallows	2	south
3	11:55	24° 07' 88° 00'		herons	10	south
3	1:10 p.m.	23° 55' 88° 00'	[18]	Purple Martin, Barn Swallow	1 each	southeast
3	1:45	23° 50' 88° 00'		Prothonotary Warbler	many	south
3	2:00	23° 47' 88° 00'		Black-and-white (?) Warbler	1	landed on deck
3	2:30	23° 42' 88° 00'	[19]	American Egret	5	south-southeast
3	2:45	23° 40' 88° 00'		Barn Swallow	1	south
3	2:50	23° 39' 88° 00'		cranes (?)	3	south
3	3:00	23° 37' 88° 00'	[20]	unidentified ducks	40	south-southeast
3	3:50	23° 34' 88° 05'		end large flight warblers and small land birds	....	.....
3	5:35	23° 31' 88° 25'	[21]	large hawk	1	south
3	5:40	23° 31' 88° 26'	[21]	Great Blue Heron	8	south
3	6:30	23° 30' 88° 36'	[22]	nighthawks	5	undetermined
4	7:40 a.m.	23° 30' 88° 38'	[22]	egrets	13	south-southeast
				Great Blue Heron	2	south-southeast
4	7:50	23° 30' 88° 38'	[22]	kingfisher	1	undetermined
4	10:30	23° 22' 88° 39'	[23]	duck-size white birds	30-40	south
4	11:30	23° 13' 88° 38'	[24]	Palm Warbler	1	alighted on deck
4	12:37 p.m.	23° 07' 88° 47'	[25]	Mourning Dove	1	south
4	12:40	23° 07' 88° 47'	[25]	pigeon-like bird	1	south
4	12:50	23° 06' 88° 48'	[25]	warblers	4	south
4	1:00	23° 05' 88° 49'	[25]	warblers	2	south
				Yellow Warbler	1	alighted on deck
4	1:25	23° 03' 88° 53'	[25]	warblers	2	south
4	3:35	22° 50' 89° 11'	[26]	warblers	5	south
4	4:25	22° 46' 89° 18'	[26]	warblers	10	south
4	4:30	22° 46' 89° 18'	[27]	warblers	25-30	southeast
4	4:35	22° 45' 89° 19'	[27]	warblers	25-30	southeast
4	4:38	22° 45' 89° 19'	[27]	warblers	20-35	southeast
4	4:40	22° 45' 89° 19'	[27]	warblers	Over 50	southeast
4	4:40-5:40	22° 39' 89° 28'	[27]	warblers	1200	southeast

Observations made aboard the "Oregon" from October 1 through October 4, 1952, are given in table 1. This trip in the course of which these observations were made was undertaken to carry on exploratory fishing near the Campeche shrimping grounds and to survey the shrimping areas off the Mexican coast south of Brownsville, Texas.

At 10:59 a.m. on October 3, 1952, the "Oregon" was 160 miles north of Yucatán, and it was traveling a true course of 180 degrees at a speed of 10 knots. At this time heavy flights of warblers and other land birds were noticed overhead. The wind was from the northeast at speeds of 15 to 18 miles per hour. The birds were not traveling at a uniform altitude, but those that came near enough to be seen well with the naked eye or binoculars were all observed to be compensating for the wind speed and direction by angling their flight and heading approximately 30 degrees to the east of south. This carried the birds on a true southward course at an estimated speed of 30 miles per hour. The largest flights were made up of from 50 to 100 individuals flying in close formation. The individual flights followed each other in rapid succession. The birds paid no attention to the "Oregon" and did not attempt to approach or land. Many birds could be seen as specks against the high cirrus and alto-cumulus cloud formations. On this day a large cumulus cloud was situated about 30 degrees above the horizon. Birds could be seen easily as they passed this cloud. In a ten minute period I was able to count about 300 birds that passed between the vessel and the cloud. Doubtless many passed unobserved. Since birds were high overhead and passing on all sides of the "Oregon," many thousands must have passed, all going south. At 3:50 p.m. a rain squall moved in from the north and no more flights were observed.

Table 2

Weather Conditions in the Period of Heaviest Migration of Birds

Date in October, 1952	Hour	Wind Direction	Wind speed (m.p.h.)	Barometer	Air temp. (F.)	Sky condition
2	12:00 p.m.	E	8-10	30:09	78	partly cloudy
3	2:00 a.m.	NNW	12-15	30:05	76	partly cloudy
3	4:00	NNE	10-12	30:08	79	partly cloudy
3	6:00	ENE	12-15	30:10	80	partly cloudy
3	8:00	ENE	12-15	30:12	82	partly cloudy
3	10:00	NE	15-18	30:14	84	partly cloudy
3	12:00 m.	NEE	15-18	30:08	88	partly cloudy
3	2:00 p.m.	NE	16-24	30:03	82	partly cloudy
3	4:00	NNE	18-25	30:08	78	north squall
3	6:00	ENE	15-18	30:06	78	partly cloudy
3	8:00	NE	15-18	30:12	78	partly cloudy
4	6:00 a.m.	NEE	18-20	30:08	75	partly cloudy
4	8:00	SE	18-20	30:01	76	cloudy
4	10:00	SE	8-12	30:11	80	partly cloudy
4	12:00 m.	SE	8-12	30:11	80	partly cloudy
4	2:00 p.m.	SE	8-10	30:00	89	partly cloudy
4	4:00	SE	6-8	29:99	85	partly cloudy
4	6:00	E	6-8	30:00	81	partly cloudy
4	8:00	NEE	15	30:03	80	partly cloudy
5	6:00 a.m.	SEE	18-20	30:02	79	partly cloudy

On October 4, 1952, the "Oregon" was on a true course of 234 degrees bound for Alacran Reef. While on this course the ship was at all times at least 80 miles north of the Yucatán Peninsula. The flights first observed were small, consisting of two to ten warblers each. A Palm Warbler (*Dendroica palmarum*) was captured at 11:30 a.m. at

latitude 23° 10', longitude 88° 40'. A Yellow Warbler (*Dendroica petechia*) was taken at 1:10 p.m. at latitude 23° 05', longitude 88° 50'. By 4:30 p.m. the size of the flights increased. For the most part the birds actively avoided coming any nearer the "Oregon" than several hundred feet. The flights approached from the open Gulf, north and northwest, and headed southeast. In a one-hour period I counted about 1200 birds crossing the bow of the ship. Those observed crossing the stern were not counted. The wind was from the southeast during the morning and early afternoon, shifting to east in the late afternoon and to northeast and east in the evening. The wind speed decreased during the day from 8 to 12 miles per hour to 6 to 8 miles per hour, and it freshened to 15 miles per hour in the evening.

The "Oregon" was anchored off Isla Desterrada, Alacran Reef, on the morning of October 5. At 11:00 a.m. about 20 warblers were observed flying southeast in the direction of Isla Desterrada. A Palm Warbler was captured at 2:00 p.m. and a half hour later a Sharp-shinned Hawk (*Accipiter striatus*) was taken. A small rowboat was used in retrieving specimens that were shot and fell into the water at some distance from the ship. A Ruddy Turnstone (*Arenaria interpres*) was collected soon after 2:30 p.m. Two Royal Terns (*Thalasseus maximus*) were picked up after having their wings badly damaged by the numerous Man-o'-war Birds (*Fregata magnificens*) in the vicinity. Two White-bellied Boobies (*Sula leucogaster*) were taken for specimens at this time. A slight breeze from the southeast held throughout the day.

At 10:10 a.m. on October 6, while shrimp trawling at latitude 20° 38', longitude 91° 15' [28] a hawk (*Buteo* sp.) was sighted traveling south by southeast. A Barn Swallow (*Hirundo rustica*) landed on deck in the afternoon and was captured; our position then was latitude 20° 12', longitude 91° 28' [29]. The wind was from the southeast at 6 to 8 miles per hour.

While at latitude 20° 13', longitude 91° 59' at 6:00 a.m. on October 7, six Blue-faced Boobies (*Sula dactylatra*) were observed heading southeast. Later in the morning the "Oregon" was anchored in six fathoms of water near Cayo del Oeste, Cayos Arcas. At noon a crew member reported sighting 30 teal heading southeast. The wind was from the north by northeast at 4 to 5 miles per hour. A Blue-faced Booby was collected. The wind velocity increased to about 25 miles per hour from the north by northeast by 3 p.m. At 4:00 p.m. several warblers were seen about the boat and one Yellow-throat (*Geothlypis trichas*) was captured. At precisely the same time an owl about nine inches in height flew into the wheel house. The Captain attempted to capture the bird but it escaped, flying rather clumsily toward the south.

The "Oregon" remained near Arcas for several days, standing by to assist crew members of three shrimp trawlers wrecked on the reef by the storm of the night of October 7. On the morning of October 9, three sparrows came about the boat. A Lincoln Sparrow (*Melospiza lincolni*) was captured. A short time later several warblers were seen and a Black-throated Green Warbler (*Dendroica virens*) was captured.

On the morning of October 10, the "Oregon" weighed anchor and departed from Cayos Arcas bound for the coast of México near Tampico. The weather was clear and the wind was from the north at 8 to 10 miles per hour. No birds were seen until 1:00 p.m., when five warblers were sighted heading southeast; the ship's position then was latitude 20° 46', longitude 92° 45' [30].

A single large fringillid was seen on October 11, at latitude 22° 19', longitude 96° 05' [31]. The bird alighted on deck, but when approached flew away and disappeared high overhead. Later on the same day at latitude 22° 25', longitude 97° 02' [32], 45 miles northeast of Tampico, México, a Myrtle Warbler (*Dendroica coronata*) was captured on deck. The wind was from the north at 4 to 6 miles per hour. An Audubon Warbler

(*Dendroica auduboni*) was taken that evening while the "Oregon" was at latitude 22° 27', longitude 97° 19' [33], 30 miles northeast of Tampico.

No birds were seen until 10:00 a.m. on October 14, when a Savannah Sparrow (*Paserculus sandwichensis*) alighted on deck and was captured. The "Oregon" at that time was at latitude 24° 57', longitude 97° 09' [34].

Inclement weather conditions prohibiting shrimp trawling forced the "Oregon" to cease operations for several days and to enter Port Brownsville, Texas. On October 20 the return trip to Pascagoula, Mississippi, commenced. Forty miles east of Port Isabel, Texas [35], a Wilson (?) Warbler (*Wilsonia pusilla*) alighted on deck. The wind was from the north at 20 to 25 miles per hour. No birds were sighted for the remainder of the passage.

All specimens that were collected have been identified by George H. Lowery, Jr., Curator, Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana, and they have been placed in the collection at that institution.

Fish and Wildlife Service, Pascagoula, Mississippi, April 6, 1953.

FROM FIELD AND STUDY

Changing Status of the Starling in Utah.—In their recent article on Starlings as winter residents in the Uinta Basin, Utah, Killpack and Crittenden (Condor, 54, 1952:343) state that "as far as could be determined the Starling has not yet become established as a breeding species in the state of Utah; however, it is possible that it nests in outlying parts of northern Utah." Actually the species was found to be nesting at Salt Lake City as early as 1949. Reference to this was recently made by Kessel (Condor, 55, 1953:49). Although she reported Starlings breeding at Salt Lake City, no details were given and the reference cited (Lockerbie, Utah Audubon News, 1(6), June, 1949:1) is a mimeographed series not generally available. It seems desirable, therefore, to summarize at this time the history of the species in Utah and to note its changing status in the state. As this bird has become established in Utah, a pattern has been followed of first appearing in small flocks during the winter, of then becoming increasingly abundant and firmly established as a winter visitant, and finally of nesting on the part of a few individuals.

The first record of the Starling (*Sturnus vulgaris*) in Utah was the discovery by Thayer Evans of 13 individuals feeding with Brewer Blackbirds at the Jeremy ranch on the northwestern outskirts of Salt Lake City on February 26, 1939. A specimen was obtained, which is now in the University of Utah Museum of Zoology. Intensive and continuous observation in the region over many years by C. W. Lockerbie and the Audubon group had failed to reveal the presence of the species in Salt Lake Valley heretofore. Subsequently, Mr. Lockerbie, the writer and others saw these few birds (Lockerbie, Condor, 41, 1939:170). A few years later, Grater (Condor, 44, 1942:41) reported the species as a migrant in southern Utah, 200 having been seen at Mt. Carmel, Kane County, on January 2, 1941.

Observations were continued by Lockerbie each winter after this in the course of his regular weekly field trips, although no special attention was given the species. A resume of his data follows: In 1940 he saw them on three occasions. On February 18 a few were mixed with a flock of Brewer Blackbirds at Haynes ranch west of Salt Lake City; on February 25 one was seen at Lehi, Utah County; on February 27, 17 were counted at the Jeremy ranch. Thus they seemed to be spreading through the region. Two observations were made in 1941 at or near the original place of occurrence. These were on February 2 and November 10. Only one observation was made in 1942 when on December 27 three were found at the Jensen Packing Plant on Second West and 30th South in Salt Lake City. The species was seen twice in 1943, when three were seen on January 3 at Jeremy's and one on December 19 at Jensen's. In 1944 four recordings were made of small groups from the various ranches and feed lots where they had been previously noted. The only observation for 1945 pertained to 19 birds seen on January 28 near Jeremy's. In 1946 they were evidently much more numerous, for Lockerbie saw them seven times, his observations being scattered through January, February, October and December. Furthermore his counts were now running into the hundreds. For instance on January 20 a flock of 250 was seen at Decker's Lake and about 200 at the new Jensen Feed Yard at 23rd South and 30th West. In 1947 he had 13 recordings with several new points of occurrence in Salt Lake Valley. This suggests that the Starlings were no longer confining themselves to the various stock yards but were roaming about the valley. He noted them feeding on Russian olives for the first time this winter, thus possibly indicating changing food habits. In 1948 there was only one listing, but this is noteworthy since the flock, seen in Davis County, numbered about a thousand birds. Starlings were noted nine times in 1949 between January 1 and March 13. In addition there were two records in October and December. This year they were seen at points within the city, as at the Capitol grounds, as well as at the feed yards and ranches west of the city. While he had only nine recordings for 1950 an increase in numbers was again indicated as well as a wider east-west spread. The flocks hanging around the feed yards still numbered in the thousands. In addition a flock of a thousand Starlings was seen on February 4 near Garfield and a flock of about a hundred was observed still farther west at Mill Pond, Tooele County. On March 5 this year Lockerbie found ten Starlings at the headquarters of the Bear River Migratory Bird Refuge in Boxelder County. The earliest fall record this year was of two seen at Magna on October 8. In 1951 there were only nine records with no impressive numbers, but the data indicate continual expansion and more general winter occupancy. The westernmost record was at Timpie Springs, northwest of Grantsville, at the northern end of the Stansbury Mountains, Tooele County. The latest date that they were seen in spring was March 11 and the earliest fall date

was September 22. In 1952 he had recordings ranging from Brigham City south through Salt Lake Valley, indicating a still wider and more general range. On April 10 a pair was observed in courting antics about his home.

The increase in the population in Salt Lake Valley through the years is nicely illustrated by the figures for the annual Audubon Christmas bird counts: 1940, 1; 1941, 5; 1942, 82; 1943, 1; 1944, 0; 1945, 5; 1946, 243; 1947, 1,143; 1948, 3,025; 1949, 4,294; 1950, 2,950; 1951, 17,542; 1952, 8,874. The discrepancy between the counts of 1951 and 1952 is probably attributable to weather conditions. In 1951 the snow was deep which caused a concentration of Starlings within the area of the count. An open winter characterized 1952 and the birds were widespread. From these data it would seem that after a few years of sporadic occurrence the population started to increase, the change being rather abrupt from 1946 on.

The first evidence of the Starling nesting in Utah came when a nest was discovered in a tree on the west side of Salt Lake City on May 25, 1949. The nest was located in an old woodpecker or flicker hole. The nesting pair was feeding young at this time. Three young were seen. The identity of the birds was determined by Thayer Evans and reported to C. W. Lockerbie who in turn made the facts known in the Utah Audubon News (*loc. cit.*). It was this note that was cited by Kessel (*loc. cit.*). As corroboration of nesting in 1949, Boyd Shaffer reported seeing young Starlings near Farmington Bay in Davis County on August 29, 1949.

There is also evidence that Starlings nested at Randolph, Rich County, in northeastern Utah in the seasons of 1950 and 1951. On May 25, 1951, some students brought to Ray Jorgensen, the school teacher at Randolph, two eggs of the Starling. They reported that Starlings had been seen to enter a shed for several successive evenings. Here a nest with four eggs was found. Two eggs were taken, which Mr. Jorgensen brought to the University of Utah. The students also stated that Starlings had nested in the same shed the previous spring.

The following miscellaneous notes have a bearing on the further spread of the Starlings in Utah. In the fall of 1948 one was reported at Kanab, Kane County, in central southern Utah by Mrs. Clara M. Shields. The bird was alive but sick when found on September 18, 1948, by children near the school where she taught. In the fall of 1949 a flock of fifty or more was noted at Richfield in central Utah. The exact date is unknown. The record comes from Miss Jennie Reynolds of nearby Monroe who received a Starling from a Mrs. Young of Richfield. Also during the fall of 1949 numerous flocks of Starlings were reported from various areas in and about Salt Lake City by Reed Ferris, Kenneth Tanner and G. A. Gump. The latter was troubled by a flock of 50 Starlings that repeatedly took grain at his home in Holladay which he had put out for pheasants. He constructed a dummy owl to frighten away the Starlings. This apparently was successful. Starlings were reported at Coalville on October 1, 1949, and near Henefer on December 6. Thayer Evans reported hordes of Starlings at Ogden Bay between October 14 and November 28, 1949.

Evidently the species is becoming ever more common in Utah Valley as suggested by the observations of Richard Hansen. During the winter of 1951-52 he found Starlings in several communities bordering Utah Lake. For instance on January 20, 1952, he saw a flock of about 150 at Payson, 200 at Santaquin, 30 at Salem, and 50 near the Geneva Steel Plant. They were frequenting apple orchards and eating dried fruit, Russian olive trees and they also visited livestock feed yards. They tended to remain in separate flocks, but on one occasion they were seen in a mixed flock with Bohemian Waxwings. In previous winters he had not seen them in the vicinity of Santaquin, his home. Robert Selander observed Starlings intermittently in the winter of 1948-49 on the western outskirts of Salt Lake City and reported that they had all left the region by March 28.—WILLIAM H. BEHLE, *University of Utah, Salt Lake City, Utah, July 15, 1953.*

Purple Gallinule in Chavez County, New Mexico.—On June 12, 1953, an adult Purple Gallinule (*Porphyrula martinica*) was collected thirty miles east of Roswell, New Mexico, on the Graham ranch, twenty miles from the nearest marsh or body of water. The bird was in a severe state of starvation and expired soon after capture. To my knowledge this species has never been recorded in the state and is not listed by any distributional works on this area. This specimen was identified with the assistance of Vester Montgomery of the New Mexico Military Institute. The skin has been sent to the United States National Museum.—SAM E. TANNER, *Roswell, New Mexico, June 22, 1953.*

Notes from Southern California and Baja California, México.—In rechecking specimens and notes at the San Diego Society of Natural History, the following records were found to add to the knowledge of ranges and habits of the species of birds involved.

Passerella iliaca altivagans. Fox Sparrow. A female taken on December 13, 1925, by J. W. Sefton, Jr., and L. M. Huey on the southern end of San Clemente Island, California, represents the second record of occurrence of this race for the island. On the same day another *Passerella* was collected. This specimen proved to be *P. i. unalaschensis*; however, this race had been previously recorded from the island.

Melospiza melodia morphna. Song Sparrow. When collecting on the desert slope at Yaqui Wells, San Diego County, California, on October 13, 1936, the writer was much surprised to see a large dark Song Sparrow hop to the top of a clump of flat-jointed cactus (*Opuntia*). It proved to be a female of this race and constituted a new southern locality of capture. Upon dissection the entire digestive tract was found to be thoroughly stained red from a diet of the ripe cactus fruit.

Spizella atrogularis cana. Black-chinned Sparrow. A male was collected two miles west of Bonita, San Diego County, California, on December 26, 1940, by the writer. This capture marks the second local winter occurrence for this race. The specimen measures, wing 62.5 mm., tail 66.5, culmen 8.3, and tarsus 18.0. This adult male has the black chin feathers showing in scattered array, indicating the start of the prenuptial molt.

Setophaga ruticilla. American Redstart. On December 23, 1950, Samuel G. Harter brought to me the remains of an adult male redstart he had picked up near the croquet courts at the southwestern corner of Balboa Park. This section is near the center of the city of San Diego, California. The remains were easily identified. In all probability the vagrant redstart had died within a few days of its discovery.

Nucifraga columbiana. Clark Nutcracker. The occurrence of this bird at Spring Valley, San Diego County, California, on November 4, 1950, was observed by Mr. George W. Polk, Jr., who wrote to me regarding its presence. Without question it had been driven from its mountain home by a three-day severe, hot, dry northeast wind. Mr. Polk stated that "The nutcracker was not wild and spent over two hours beneath an avocado tree where a water sprinkler was playing."

Piranga rubra rubra. Summer Tanager. A female of this species was collected at the Beemer ranch seven miles east of Pala, San Diego County, California, on January 9, 1953. For several weeks the bird had been feeding at the feeding station operated by Mr. and Mrs. Beemer, from whom permission to collect it was generously granted in order to authenticate this unusual record.

Corvus corax sinuatus. Raven. Mr. Laurence Saunders, who operates a turkey farm at Hillsdale near El Cajón, California, reported considerable trouble with a pair of ravens that stole turkey eggs. These sagacious birds would even invade the open-doored nest house to secure eggs. In the later afternoon of May 6, 1951, this pair of ravens was seen taking wing from the turkey pen. One of them was carrying an egg in its beak. The ravens flew to an open, recently mown hay field about a quarter of a mile from the turkey pen, where both birds alighted. The egg was placed on the ground at which moment Mr. Saunders shot the raven with a 30 calibre service rifle from a vantage point some 250 yards distance. Upon retrieving the bird, the egg was found to be uninjured and was placed in the regular collection to be sent to the hatchery.

Geothlypis trichas occidentalis. Yellow-throat. A female, brought to me in the flesh, was taken on Guadalupe Island, Baja California, México, on November 12, 1938, by Lewis W. Walker. This capture represents the first record of a Yellow-throat for this remote off-shore island.

Cygnus columbianus. Whistling Swan. A female of this species, brought to the museum to be identified and later donated, was shot at La Paz, Baja California, México, on November 4, 1950. It was killed by a hunter who desired to remain unidentified. This marks an extreme southern record for this swan which had not hitherto been recorded south of the Sierra Juárez in the northernmost section of the peninsula.

Elanus leucurus majusculus. White-tailed Kite. About mid-morning, on August 27, 1953, while collecting at Laguna Santa Maria near San Quintín, Baja California, México, an adult White-tailed Kite was watched for almost half an hour while it coursed the brackish marsh, hunting. Several times the beautiful bird came within close gun range, so close in fact, that the yellow feet were plainly visible. It was not molested. The kite was working the marsh in search of meadow mice (*Microtus*), which were abundant. Rising to perhaps a hundred feet in the air, it would hover with fairly rapid wing beats, searching the ground below; then setting its wings in an upward "V" it would drop its feet,

hang its head downward with its eyes evidently on prospective prey, and descend rather slowly almost to the ground. Here it would hover searching further for its prey. While descending, the extended feet and head would swing to and fro. The tail, which was held almost straight in line with the body, was spread and contracted, balancing the rather slowly falling kite. This performance reminded me of the descent of a helicopter. During several such pursuit drops the kite did not make a food capture. —LAURENCE M. HUEY, *Natural History Museum, Balboa Park, San Diego, California, July 27, 1953.*

Food of the Long-eared Owl in Southern Washoe County, Nevada.—On March 5, 1953, a pair of adult Long-eared Owls (*Asio wilsonianus*) was found roosting in a single-needle piñon at 4800 feet in the foothills of the Virginia Range, 11 miles southeast of Reno, Washoe County, Nevada. Subsequent visits to the locality were made on March 26, April 30, and May 21, 1953. Two birds, an adult and one volant young judged to be about five weeks old, were present on the latter date near an old magpie nest. On the last three trips to the area I gathered 131 pellets from the ground beneath several piñon trees in the vicinity. Because most of the pellets had been protected from the weather by thick piñon cover, the majority of the skulls they contained were well preserved. An analysis of the contents of these pellets follows. Each item listed was represented by a complete skull or by a recognizable skull fragment.

	Number of items	Per cent of total
Pocket Mouse, <i>Perognathus parvus</i>	18	15.80
Kangaroo Rat, <i>Dipodomys panamintinus</i>	18	15.80
Pocket Gopher, <i>Thomomys talpoides</i>	2	1.75
<i>Thomomys</i> sp.	3	2.64
Harvest Mouse, <i>Reithrodontomys megalotis</i>	15	13.16
Deer Mouse, <i>Peromyscus (maniculatus) ?</i>	21	18.40
Meadow Mouse, <i>Microtus montanus</i>	34	29.82
Jackrabbit, <i>Lepus californicus</i>	2	1.75
Western Meadowlark, <i>Sturnella neglecta</i>	1	.88
Total	114	100.00

All of the *Dipodomys* skulls and all but one of the *Perognathus* skulls were identified to species on the basis of geographic range. Rabbit remains were frequent beneath scattered piñons in the area, but I could find only two skulls, neither of which was contained in a pellet.

The locality is situated at the ecotone of the piñon-juniper-sagebrush-grass zones, and is approximately one-half mile from the nearest meadowland. Thus it is interesting to compare the percentage of prey animals of moist, grassy environments (harvest and meadow mice, pocket gophers, and meadowlarks), which totals 48.25, to that of the remaining species of normally dry habitat which totals 51.75. Although the owls roosted in the piñon, about half of the feeding was apparently done in the meadowland area one-half mile distant. Groves of large cottonwoods and willow thickets near the moist area would seem to be suitable for both roosting and nesting of these owls, although no signs of such activity have been noted there.—NED K. JOHNSON, *University of Nevada Museum of Biology, Reno, Nevada, July 19, 1953.*

Falcated Teal at San Francisco, California.—On May 5, 1953, I found a strange duck on Stow Lake in Golden Gate Park, San Francisco, California. Robert T. Orr, Sandy Sprunt, and I later identified it as a Falcated Teal (*Anas falcata*). It had previously been seen on Metson Lake in the park on April 5, by A. Laurence Curl. The bird remained on Stow Lake until May 20 or 21.

There have been at least three records of *Anas falcata* in North America (Hanna, Auk, 37, 1920: 250; Brooks, Condor, 44, 1942:33; Wilson, Condor, 50, 1948:127). It is native to eastern Asia. The possibility that the bird at Stow Lake was an escaped bird or a descendant of an escaped bird is good, as the species has been introduced frequently.—JOEL T. HEDGPETH, *San Francisco, California, July 21, 1953.*

The Prothonotary Warbler in California.—On May 25, 1953, the senior author picked up a Prothonotary Warbler (*Protonotaria citrea*) on the grounds of Dial House, 505B E. Los Olivos, Santa Barbara, Santa Barbara County, California. The bird was an adult male with the testes enlarged to breeding size. Mr. Egmont Rett of the Santa Barbara Museum of Natural History confirmed our

identification and made up the skin which is now specimen no. 4258 in the collection of the Santa Barbara Museum of Natural History.

Dial House is in Mission Canyon near Mission Creek and lies between the Santa Barbara Museum of Natural History and The Mission. The grounds and the adjacent areas have many trees and shrubs which make a narrow wooded strip in a residence section. The bird evidently was killed by flying into something high on or near the house and was one of three birds similarly found within a period of a few days. The two days preceding had been clear or with high, thin clouds and were average in temperature. They were unusual in having strong west and southwest winds varying from 13 to 30 miles per hour from about noon until late in the evening.

Prior to this the westernmost records of occurrence of this warbler were from Arizona. Peet (Condor, 50, 1948:134) records one specimen taken in that state in 1884 and one in 1924.—MARIANNE HILLMAN and MARY M. ERICKSON, *University of California, Santa Barbara, California, August 14, 1953.*

Courtship Activities of the Inca Dove.—On March 6, 1951, at Terminal, elevation 6700 feet, in northern Zacatecas, México, I had an opportunity to observe courtship activities of a pair of Inca Doves (*Scardafella inca*) on the ground. The bird presumed to be the male circled the female, dipping its head, spreading its tail, and extending its wings on a "V" over the body, thus showing the chestnut of the wings to full advantage. These activities differ considerably from those described as courtship by Bent (U. S. Nat. Mus. Bull. 162, 1932:444) based on Frank Stephens' statement (1885): "I saw a little group on the ground, the males strutting around the females, carrying their tails nearly vertical and cooing."—FRED G. EVENDEN, *Sacramento, California, August 28, 1953.*

Mountain-top Visits by Birds at Aspen, Colorado, in Winter and Early Spring.—Some observations recently made at Aspen, Pitkin County, in west-central Colorado, indicate that several passerine species are prone to move upslope and to forage on mountain tops in winter and early spring. Certain movements appear to be daily excursions which carry the birds many hundreds of feet above their roosting areas. Because mountain summits are, in large part, struck by the sun's rays earlier and later in the day than are the relatively narrow, intervening valleys, such as are characteristic of this region, the effective time for feeding by birds would surely seem to be longer at the higher altitudes. Lack (Proc. 10th Internat. Ornith. Congress, 1951:440) states and documents the fact that passerines "retire to roost later with respect to sunset in midwinter than in autumn, indicating that when days are shortest, the birds need to collect food up to the last possible moment." Thus, it seems reasonable to theorize that some birds, especially those with strong powers of flight, might well take advantage of mountain tops on sunny days for feeding purposes and might utilize the very early morning and late afternoon hours as well as other times of the day. Inasmuch as a mountain-top invasion at sunrise was once noted by one of us (Gardner), we have been led strongly to suspect that not only the presence of ample forage on the summit but also the matter of feeding time was, indeed, an important factor influencing such a movement. Pertinent details that suggest the likelihood of upslope invasions of this type are as follows:

Gardner, who lived on the side of Red Mountain, northeast of Aspen, in the winter of 1952-53, was first visited by Hebard from January 30 to February 2, 1953; during this period, only one Steller Jay (*Cyanocitta stelleri*), American Magpies (*Pica pica*), and one fringillid, of uncertain identity, were noted. Gardner had seen very little else at his feeder since mid-December. By contrast, we found on Richmond Hill, at an elevation of 11,300 feet, on February 2, a different situation. The snow-covered top of this mountain supported Engelmann spruce and limber pine, with Douglas fir up to 10,500 feet. Between 10:30 and 11 a.m., Canada Jays (*Perisoreus canadensis*), Bohemian Waxwings (*Bombicilla garrula*), Pine Grosbeaks (*Pinicola enucleator*), Red and White-winged crossbills (*Loxia curvirostra* and *L. leucoptera*), and a Brown-capped Rosy Finch (*Leucosticte australis*) were observed, all or nearly all coming from the west slope. On the way up or down the ski-tow, we noted chickadees (probably Mountain Chickadees, *Parus gambeli*), Pine Siskins (*Spinus pinus*), and juncos (probably Gray-headed Juncos, *Junco caniceps*). On February 5 Gardner found a Cassin Finch (*Carpodacus cassinii*) on top of Richmond Hill, but it did not appear at his feeder at 8300 feet until March 26.

It was March 10 before there was an increase in individuals and kinds of birds at Gardner's feeder. By March 25, when Hebard revisited the area, the density and variety of birds had increased in the valleys not far below and was greater, in fact, than it was on the summit of Richmond Hill, on

March 29, from 10:30 a.m. to 2 p.m. However, it should be pointed out that some of the valleys and adjacent slopes other than the ones we saw doubtless had considerable numbers and kinds of birds all winter, at least at certain times of day, and these uninvestigated valleys, as well as higher slopes, presumably yielded most of the passerines that made visits to the mountain tops.

The most spectacular upslope invasion was observed by Gardner on April 5, on the summit of Richmond Hill, which he reached before sunrise. The birds came with the first rays of sunlight. Red and White-winged crossbills were predominant, and Pine Siskins ranked next in abundance. At about 7 a.m. Pine Grosbeaks appeared. A half hour later a flock of Gray-headed Juncos came in, spread over the summit and remained until Gardner left at 10 a.m. Canada Jays, which had been common on this summit at midday on several previous occasions, appeared about 9 a.m. So far as could be determined, the entire group came up the east slope (from Difficult Creek Valley) rather than the west slope as they had on previous occasions. Spruce seeds were the main source of food. The crossbills, Pine Siskins, and Pine Grosbeaks left about 9 a.m. and did not return, at least not within the following hour.

More extensive observations and study will be necessary if we are to establish with certainty the fact that such "vertical movements" tend to be daily in nature and are governed by the feeding-time factor more than by any other. In late winter and early spring some migratory, northward and upward movements might be under way and might complicate the picture. The passerines making up the bulk of the flocks that we saw are, moreover, well known for their irruptions and their generally irregular manner of occurrence. Hence we wish merely to say that feeding time or effective daylength was possibly of importance in eliciting such upslope movements. The same factor might also be influential with regard to birds that wander, in middle or late summer, higher than their nesting habitat in the Rocky Mountains, as noted by Packard (Auk, 63, 1946:152-158) and many others.—FREDERICK V. HEBARD, *Philadelphia, Pennsylvania*, and ALFRED W. GARDNER, *Princeton, New Jersey, August 30, 1953*.

A Winter Record for the Swamp Sparrow in the Imperial Valley, California.—On January 31 and February 1, 1953, we were studying birds at a freshwater marsh where a drainage canal entered the Salton Sea west of Niland, Imperial County, California. On the evening of January 31, we heard the unmistakable call of the Swamp Sparrow. Upon searching the area from which the call came, we located the bird and observed it at close range. At this time, we heard another Swamp Sparrow calling a short distance from us. We were not able to secure either one at this time, but the next morning, February 1, we again heard the call note from a tangle of vegetation along the edge of the canal and obtained the bird. The specimen proved to be an adult male Swamp Sparrow (*Melospiza georgiana*) and is now number 2059 in the Cardiff Collection.

Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:542) list no records for the Swamp Sparrow in the Imperial Valley. This is the fifth occurrence for the Swamp Sparrow in California.—EUGENE CARDIFF and BRUCE CARDIFF, *Bloomington, California, March 31, 1953*.

NOTES AND NEWS

Members of the Cooper Ornithological Society are reminded of the forthcoming annual meeting, April 22 to 24, 1954, at Tucson, Arizona. A call for papers will soon be issued by the local committee.

Because the study of birds brought much pleasure to the wife of a Pasadena philanthropist during the ill health of her later years, bird students of southern California will benefit from a \$75,000 fund to be established at the University of California at Los Angeles in her memory. The gift is from the estate of the late Scott Brown and will be known as the Lida Scott Brown Fund.

The provisions of the estate are that "the income from said fund shall be used annually, under the direction of the department in which the ornithological work is given at the University of California at Los Angeles, to provide, through the facilities of the university or through individuals or organizations outside the university, the best opportunity or opportunities, in the judgment of the directing person or board of said department, for the furtherance of the knowledge of birds in people who are already interested in bird study and in those who might be interested if introduced to the subject in a favorable way." The fund will be administered by the zoology department at Los Angeles. Tentative plans call for annual lectures by prominent ornithologists and preparation and dissemination of literature on the subject.

Mrs. Brown first became interested in bird study, some years before her death in 1943, when she was a member of the Cooper Ornithological Society and the Western Bird Banding Association. Members of these organizations remember her for her intense, scholarly interest in birds.

The Eleventh International Ornithological Congress at Basel, Switzerland, will meet from May 29 to June 5, 1954. Field excursions are scheduled before and after the Congress. The International Committee for Bird Preservation will hold its Ninth International Conference, prior to the Congress, at Scans, Switzerland, May 23 to 28.

COOPER SOCIETY MEETINGS

SOUTHERN DIVISION

MAY.—The monthly meeting of the Southern Division of the Cooper Ornithological Society

was held on May 26, 1953, at the University of Southern California. The following names were proposed for membership: Hal Armitage, 447 S. Mariposa, Apt. 2, Los Angeles 5, Calif., by C. J. Parker; Henry R. Davis, 418 Floral Park Terrace, South Pasadena, Calif., by J. R. Pemberton; Dr. F. J. Appelman, Rotterdam Zoo, Blijdorp, Holland, Dr. William G. Baldwin, Box 1077, Quincy, Wash., Mrs. Anna May Ewing, 2352 Delaware Court, Tulsa, Okla., Robert L. Haines, 54 E. Main St., Moorestown, N. J., Joseph G. Hurley, 241 W. Stocker, Glendale, Calif., Jack Neville, 152 Peck Dr., Beverly Hills, Calif., and Dr. Abelardo Moreno, Museo Poey, Catedro "U" Escuela de Ciencias, Universidad de La Habana, La Habana, Cuba, all by C. V. Duff.

Thomas R. Howell reviewed the new bird guide, "Birds of Mexico," by Emmett R. Blake.

James N. Bartel reported that in May, 1953, a pair of House Finches had hatched two young birds in a nest built in the hood of a Ford panel truck operating at the Pomona Division of Consolidated Vultee Aircraft Corporation. This truck had made several trips covering more than one hundred miles over a period of several weeks. The hood had been raised and lowered for servicing of the engine without dislodging the nest. Despite the precarious site, two birds were fledged.

"Out of the North," a colored sound motion picture, was shown through the courtesy of Ducks Unlimited and J. R. Pemberton.—DOROTHY E. GRONER, *Secretary*.

SEPTEMBER.—The monthly meeting of the Southern Division was held on September 29, 1953, at the Los Angeles County Museum. The following names were proposed for membership: Florence Carey Chamberlain, 4255 Lowell Dr., Des Moines 12, Ia., by Junea W. Kelly; Sanger Hedrick, Jr., Rt. 1, Box 43, Simi, Calif., by J. S. Appleton; Oliver H. Hewitt, Fernow Hall, Cornell University, Ithaca, N.Y., by Charles G. Sibley; Gordon L. Wall, 1427 Trujillo Rd., S.W., Albuquerque, N.M., by A. H. Miller; Gerald Collier, 3634 No. Muscatel Ave., Rosemead, Calif., and Russell B. Mapes, 1112-D Pico Blvd., Santa Monica, Calif., both by T. R. Howell; G. F. Bodman, 105 Seymour St., Kamloops, British Columbia, Canada, Joel T. Hedgpeth, 1201 29th Ave., San Francisco 22, Calif., Mr. Alexander Horn, Westdeutsche Bibliothek, Spiegelgasse 9, Wiesbaden, Germany (U.S. Zone), John M.

Kern, 367 Cerro Romauldo Ave., San Luis Obispo, Calif., and Dr. H. O. Wagner, % Museum für Natur, Völker- und Handelskunde, Bahnhofplatz, Bremen, Germany, all by J. C. von Bloeker, Jr.; Carl Berryman, 128 West Euclid Ave., Stockton 4, Calif., Mrs. Robert V. D. Booth, 1085 Bank St., Painesville, Ohio, Donald M. Bradburn, 461 Pine St., New Orleans, La., Edward von Siebold Dingle, Middleburg Plantation, Huger, S.C., Ernest P. Edwards, Camp Detrick, Frederick, Md., Frederick M. Helleiner, Box 3, Grande Prairie, Alberta Chester L. McAlexander, Star Route, Huntingdon, Tenn., Stanley J. D. Oswald, 260 Wellington Crescent, Winnipeg, Manitoba, Don Smith Prentice, 1529 5th Ave., Los Angeles 19, Calif., Mrs. L. O. Waldorf, 1514 Le Roy Ave., Berkeley, Calif., and S. B. Young, M.D., Shaughnessy Hospital, Vancouver, B.C., all by C. V. Duff.

Chester C. Lamb was proposed for Honorary Membership by John Davis, Jean M. Linsdale, Alden H. Miller and Loye Miller.

A communication from R. L. Pyle was read announcing publication of his booklet "Annotated Field List of the Birds of Southern California," in which are listed all species that occur in southern California, showing graphically which months they are present and giving an indication of the ease with which they may be found.

"Birds of Guadalupe Island" was the subject of the speaker, Thomas R. Howell.—GRETCHEN SIBLEY, *Acting Secretary*.

NORTHERN DIVISION

SEPTEMBER.—The monthly meeting of the Northern Division was held on September 3, 1953, at the University of California, Berkeley.

In place of a guest speaker, the meeting was turned over to a discussion of recent literature and field observations.

Reviews of literature were given as follows: Robert K. Selander reviewed Blake's "Birds of Mexico." Mrs. J. W. Kelly mentioned a recent issue of Leaflets of Western Botany commemorating the centennial of the California Academy of Sciences. Alden H. Miller gave a preview of a forthcoming Avifauna which will feature 40 life history studies of Central American birds by Alexander Skutch. Robert T. Orr reviewed Bent's "Life Histories of North American Wood Warblers," Macworth-Praed's and Grant's "The African Handbook of Birds, Volume 1," and Hachisuka's "The Dodo and Kindred Birds."

Among field observations reported were the following: Robert T. Orr recorded a Black-

and-White Warbler found dead at the California Academy of Sciences on August 31. Louis A. Elmore described a nest of the Hooded Oriole in a palm tree in Berkeley on April 26; young were being fed a month later. Kenneth Schulz saw Cowbirds commonly this summer at Yosemite Park and four Fulvous Tree-ducks near Rush Creek Checking Station, Mono Lake, on June 24. Sterling Bunnell told of his recent visit to Argentina and showed several colored slides depicting various bird species and habitats.—ROBERT K. SELANDER, *Secretary*.

OCTOBER.—The monthly meeting of the Northern Division was held on October 1, 1953, at the University of California, Berkeley.

The following observations were reported: one female American Redstart in Golden Gate Park, San Francisco, on September 19, by Florence Plymell; three Pectoral Sandpipers, three Stilt Sandpipers, and one Pomerine Jaeger at Bay Farm Island, Alameda, on September 23, by Junea W. Kelly; six Wilson Phalaropes at Bay Farm Island on September 6 and one Waterthrush at Dymond Canyon, Oakland, on September 10 by Kenneth Schulz.

The speaker of the evening was Mrs. Junea W. Kelly, whose topic was "Birding in South America, without a handbook."—ROBERT I. BOWMAN, *Acting Secretary*.

NOVEMBER.—The monthly meeting of the Northern Division was held on November 5, 1953, at the University of California, Berkeley.

Final reading was given to the proposal of Chester C. Lamb for Honorary Membership and election was ordered by an unanimous vote. The following proposals for membership were read: Mr. Hal M. Boeker, Fort Collins, Colo., by Alden H. Miller; Miss Ailene E. Bonestall, Berkeley, Calif., by Robert I. Bowman. Mrs. Junea W. Kelly proposed Mrs. Kathlene Skelton of New York City for Life Membership.

Robert T. Orr reviewed "The Land Birds of America" by Murphy and Amadon, calling attention to the numerous reproductions in color and black and white of the outstanding photographs of many famous bird photographers. Joe Hall called the attention of members to a new book entitled "Round River" which contains hitherto unpublished notes of the late Aldo Leopold.

The speaker of the evening was David W. Johnston whose talk was entitled "In Quest of the California Gull at Mono Lake."—ROBERT I. BOWMAN, *Acting Secretary*.

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FOR SALE—Ibis, complete set from beginning to 1938 (bound in leather) ; Journal für Ornithologie, complete set from 1853 to 1938 (also bound in leather). Write to advertiser for further information.—**ERNST MAYR**, Museum of Comparative Zoology, Harvard College, Cambridge 38, Mass.

BINOCULAR INFORMATION—For a simplified easy way to check the alignment of a binocular, see our new article in January–February Audubon Magazine. To learn how to choose the model best for your purpose and get the most from it, read our "Know Your Binoculars" previously published in Audubon Magazine; fully illustrated reprint 10¢ (no charge to members of Cooper Ornithological Society). If your glass needs repair or coating send it to us for a free estimate. If you need a new one, send for our list of American, German and Japanese glasses. All are guaranteed adjusted to U. S. Government specifications and are sent on 20 days' free trial. Liberal trade-in allowance made. We also check glasses without charge and answer questions personally. If you have a binocular problem, let us help you solve it.—**THE REICHERTS**, Mirakel Repair Co., Mount Vernon 15, N. Y.

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